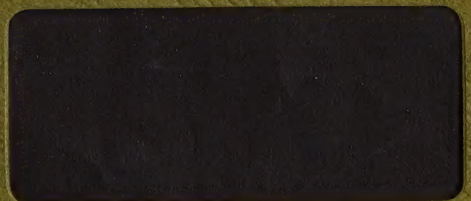


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INSTRUCTION MANUAL



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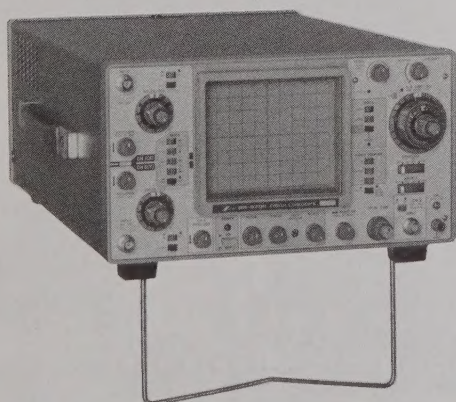


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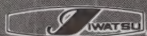


SERVICE MANUAL



OSCILLOSCOPE SS-5706 SERVICE MANUAL

岩崎通信機株式会社



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Specifications

1-1 GENERAL

The Iwatsu SS-5706 is 30 MHz triple event observation oscilloscopes.

Their precision and performance are comparable to high grade models and they can be used for a variety of measurement applications such as production line, maintenance, research, and development.

The SS-5706 has the following features:

■ High precision and stability

- Vertical and horizontal axis sensitivity is within $\pm 2\%$. (at 10°C to 35°C)
- High precision calibrator
Frequency accuracy $\pm 1\%$ (at 10°C to 35°C)
Voltage amplitude accuracy $\pm 1\%$ (at 10°C to 35°C)

■ Variety of high grade functions

- Highest acceleration voltage in its class 12 KV
High intensity 6 inch rectangular CRT with illuminated scale
- Displaying of 6 traces with the use of triple event alternate sweep function

● Swept delay function

Usability not attainable with trigger delay method

● Triple even display and ADD operation

Vertical axis sensitivity magnification (CH-1) 1 mV/div

● First in this class to use jitterless synchronization circuit

Enables measurement of high speed signals with little or no jitters

● Hold off variable function

Effective when synchronizing with complicated signals.

Video signal separation circuit

● CH-1 signal output function

Useful when use together with counter

● Maximum sweep time of 10 ns/div

● Single sweep function, beam finder function, trace rotation function

● Fix synchronization circuit

■ Small and light weight

■ Practical design for ease of operation

1-2 ELECTRICAL SPECIFICATIONS

1-2-1 Cathode-Ray Tube (CRT)

Shape	Rectangular, 6 inches
Display Area	8 divx10 div (1 div = 10 mm), with internal graticule of parallax-free type
Phosphor	B31
Accelerating Voltage	Approximately 12 kV

1-2-2 Vertical Deflection System

Modes	CH 1, CH 2, ADD, DUAL/ TRI (ALT, CHOP), X-Y CHOP switching rate: approximately 130 kHz
-------	---

Channels 1 and 2

Deflection Factor	5 mV/div to 10 V/div, in 11 calibrated steps in a 1-2-5 sequence Accuracy: $\pm 2\%$ (at 10°C to 35°C) 5 mV/div to 25 V/div, con- tinuously variable with the VARIABLE control x5 MAG (CH1 only) 1 mV/ div Accuracy: $\pm 4\%$ (at 10°C to 35°C)
-------------------	---

Frequency Response	DC to 30 MHz, -3 dB (5 mV/div to 0.2 V/div) DC to 20 MHz, -3 dB 1 mV/div, 2 mV/div (in the x5 MAG mode) Notes • 10°C to 35°C • AC coupling: The lowest useable frequency is 4 Hz.
--------------------	---

Pulse Response	Overshoot: 7% Sag (at 1 kHz): 2% Other distortions: 5% (5 mV/div, 10°C to 35°C)
----------------	---

Signal Delay	
Input Coupling	AC, DC, GND
Input RC	Direct: 1 M Ω $\pm 2\%$ // 32 pF ± 3 pF With probe: 10 M Ω $\pm 3\%$ // 21 pF ± 3 pF

Maximum Input Voltage	Direct: 400V (DC + peak AC) With probe: 600V (DC + peak AC)
Drift	0.5 div/hour (5 mV/div) or 2.5 div/hour (1 mV/div) 30 minutes after power is turned on (Standard)

Common Mode Rejection Ratio	5 mV/div 40 : 1 (1 kHz sine wave) 15 : 1 (5 MHz sine wave)
Polarity Inversion	CH 2 only

Channel 3

Deflection Factor	0.1 V/div Accuracy: $\pm 3\%$ (at 10°C to 35°C)
Frequency Response	DC to 30 MHz, -3 dB Notes • 10°C to 35°C • AC coupling: The lowest usable frequency is 4 Hz.
Pulse Response	Overshoot: 10% Sag (at 1 kHz): 3% Other Distortions: 9% (10°C to 35°C)
Input Coupling	AC, DC
Input RC	Direct: 1 M Ω $\pm 2\%$ // 32 pF ± 8 pF With probe: 10 M Ω $\pm 2\%$ // 21 pF ± 3 pF

Maximum Input Voltage

Direct:

400 V (DC +peak AC)

With probe:

600V (DC +peak AC)

1-2-3 Triggering

Signal Source	CH 1, CH 2, CH 3, LINE, (External trigger can be used by selecting CH 3 with SOURCE switch.)
Coupling	AC, DC, HF REJ, TV (A-sweep: TV-V, B-sweep TV-H)
Slope	Positive-going (+), Negative-going (—)
Minimum Trigger Sensitivity	As shown in Table 1-2-3

Table 1-2-3 (at 10°C to 35°C)

Frequency Range	Sensitivity	
	CH 1, CH 2	CH 3
DC to 5 MHz	0.5 div	1 div
5MHz to 30 MHz	1.5 div. (B: 2 div)	3 div

Note

- In TV-mode, synchronization is achieved when amplitude is more than 1 div when composite signal consisting of video signal 7 and synchronization signal 3 is input.
- Trigger signals are attenuated in the following frequency ranges depending on coupling
AC: 10 Hz or less
HF REJ: 10 kHz or higher
- AUTO sweep mode: The lowest useable frequency is 50 Hz.

1-2-4 Horizontal Deflection System

Modes

A, A INTEN, B (DLY'D)

A-Sweep

Sweep Modes

AUTO, NORM, SINGLE

Sweep Rates

0.1 μ sec/div to 0.5 sec/div,
in 21 calibrated steps in a 1-2-5
sequence0.1 μ sec/div to 1.25 sec/div, con-
tinuously variable with the
VARIABLE controlAccuracy I (Over center 8 divi-
sions): $\pm 2\%$ (at 10°C to 35°C)Accuracy II (Over any 2 of the
center 8 divisions): $\pm 5\%$ (10°C to $\pm 35^\circ\text{C}$)

Hold-Off Time

Variable with the HOLDOFF
control

B-Sweep

Delay

Continuous delay (RUNS AF-
TER DELAY), triggered delay
(TRIG'D)

Sweep Rates

0.1 μ sec/div to 50 msec/div,
in 18 calibrated steps in a 1-2-5
sequenceAccuracy I (Over center 8 divi-
sions): $\pm 3\%$ (at 10°C to 35°C)Accuracy II (Over 2 of the cen-
ter 8 divisions): $\pm 5\%$ (at 10°C to + 35°C)

Delay Jitter

1/20,000 or less

Sweep Magnification

5 times

(Maximum sweep rate: 20 nsec/
div)Accuracy I of magnified sweep
rate (Over center 8 divisions) $\pm 5\%$ at 20 nsec/div to 0.1 sec/div
(at 10°C to 35°C)Exclude the first 2 divisions for
20 ns/div.

Accuracy II of magnified sweep rate (Over any 2 of the center 8 divisions):

$\pm 6\%$ at 0.2 $\mu\text{sec}/\text{div}$ to 0.1 sec/div (at 10°C to 35°C)

1-2-5 X-Y Operation

Signal Input	X axis: CH1, Y axis: CH 2
X Axis	X axis: CH1, Y axis: CH 2
Deflection Factor	Same as that of CH 1 Accuracy: $\pm 5\%$ (at 10°C to 35°C)
Frequency Response	DC to 2 MHz, -3 dB
Input RC	Same as that of CH 1
Maximum input voltage	Same as that of CH 1
Y Axis	same as CH 2
X-Y Phase Difference	3° or less (at DC to 50 kHz)

1-2-6 External Brightness Modulation

Input Voltage	3 Vp-p
Polarity	Positive decreases intensity negative increases intensity
Frequency Range	DC to 1 MHz
Input Resistance	10 k Ω $\pm 20\%$
Maximum Input Voltage	50 V (DC +peak AC)

1-2-7 Calibrator

Waveform	Square wave
Repetition Frequency	1 kHz Accuracy: $\pm 1\%$ (at 10°C to 35°C)
Duty Ratio	40% to 60%
Output Voltage	0.3 V Accuracy: $\pm 1\%$ (at 10°C to 35°C)
CH 1 Signal Output	
Output Voltage	50 mV $\pm 20\%$ per displayed amplitude division
Bandwidth	DC to 10 MHz, -3 dB

1-2-8 Power Supply

Voltage Range	100V (90 to 110 V)/ 115V (103 to 128 V)/ 220V (195 to 242 V)/ 230, 240V (207 to 264 V)/AC One of these voltage ranges can be selected with voltage selector plug (A, B, C, D)
Frequency Range	50 to 440 Hz
Power Consumption	Approximately 48 W (at 100 VAC)

Maximum Input Voltage	
Direct:	400 V (DC +peak AC)
With probe:	600V (DC +peak AC)

1-2-3 Triggering

Signal Source	CH 1, CH 2, CH 3, LINE, (External trigger can be used by selecting CH 3 with SOURCE switch.)
Coupling	AC, DC, HF REJ, TV (A-sweep: TV-V, B-sweep TV-H)
Slope	Possitive-going (+), Negative-going (—)
Minimum Trigger Sensitivity	As shown in Table 1-2-3

Table 1-2-3 (at 10°C to 35°C)

Frequency Range	Sensitivity	
	CH 1, CH 2	CH 3
DC to 5 MHz	0.5 div	1 div
5MHz to 30 MHz	1.5 div. (B: 2 div)	3 div

- Note
- In TV-mode, synchronization is achieved when amplitude is more than 1 div when composite signal consisting of video signal 7 and synchronization signal 3 is input.
 - Trigger signals are attenuated in the following frequency ranges depending on coupling
AC: 10 Hz or less
HF REJ: 10 kHz or higher
 - AUTO sweep mode: The lowest useable frequency is 50 Hz.

1-2-4 Horizontal Deflection System

Modes	A, A INTEN, B (DLY'D)
A-Sweep	
Sweep Modes	AUTO, NORM, SINGLE
Sweep Rates	0.1 μ sec/div to 0.5 sec/div, in 21 calibrated steps in a 1-2-5 sequence 0.1 μ sec/div to 1.25 sec/div, con- tinuously variable with the VARIABLE control Accuracy I (Over center 8 divi- sions): $\pm 2\%$ (at 10°C to 35°C) Accuracy II (Over any 2 of the center 8 divisions): $\pm 5\%$ (10°C to $\pm 35^\circ\text{C}$)
Hold-Off Time	Variable with the HOLDOFF control
B-Sweep	
Delay	Continuous delay (RUNS AF- TER DELAY), triggered delay (TRIG'D)
Sweep Rates	0.1 μ sec/div to 50 msec/div, in 18 calibrated steps in a 1-2-5 sequence Accuracy I (Over center 8 divi- sions): $\pm 3\%$ (at 10°C to 35°C) Accuracy II (Over 2 of the cen- ter 8 divisions): $\pm 5\%$ (at 10°C to + 35°C)
Delay Jitter	1/20,000 or less
Sweep Magnification	5 times (Maximum sweep rate: 20 nsec/ div) Accuracy I of magnified sweep rate (Over center 8 divisions) $\pm 5\%$ at 20 nsec/div to 0.1 sec/div (at 10°C to 35°C) Exclude the first 2 divisions for 20 ns/div.

Accuracy 11 of magnified sweep rate (Over any 2 of the center 8 divisions):
 $\pm 6\%$ at $0.2 \mu\text{sec/div}$ to 0.1 sec/div (at 10°C to 35°C)

1-2-5 X-Y Operation

Signal Input	X axis: CH1, Y axis: CH 2
X Axis	X axis: CH1, Y axis: CH 2
Deflection Factor	Same as that of CH 1 Accuracy: $\pm 5\%$ (at 10°C to 35°C)
Frequency Response	DC to 2 MHz, -3 dB
Input RC	Same as that of CH 1
Maximum input voltage	Same as that of CH 1
Y Axis	same as CH 2
X-Y Phase Difference	3° or less (at DC to 50 kHz)

1-2-6 External Brightness Modulation

Input Voltage	3 Vp-p
Polarity	Positive decreases intensity negative increases intensity
Frequency Range	DC to 1 MHz
Input Resistance	$10 \text{ k}\Omega \pm 20\%$
Maximum Input Voltage	50 V (DC +peak AC)

1-2-7 Calibrator

Waveform	Square wave
Repetition Frequency	1 kHz Accuracy: $\pm 1\%$ (at 10°C to 35°C)
Duty Ratio	40% to 60%
Output Voltage	0.3 V Accuracy: $\pm 1\%$ (at 10°C to 35°C)
CH 1 Signal Output	
Output Voltage	50 mV $\pm 20\%$ per displayed amplitude division
Bandwidth	DC to 10 MHz, -3 dB

1-2-8 Power Supply

Voltage Range	100V (90 to 110 V)/ 115V (103 to 128 V)/ 220V (195 to 242 V)/ 230, 240V (207 to 264 V)/AC One of these voltage ranges can be selected with voltage selector plug (A, B, C, D)
Frequency Range	50 to 440 Hz
Power Consumption	Approximately 48 W (at 100 VAC)

1-3 PHYSICAL CHARACTERISTICS

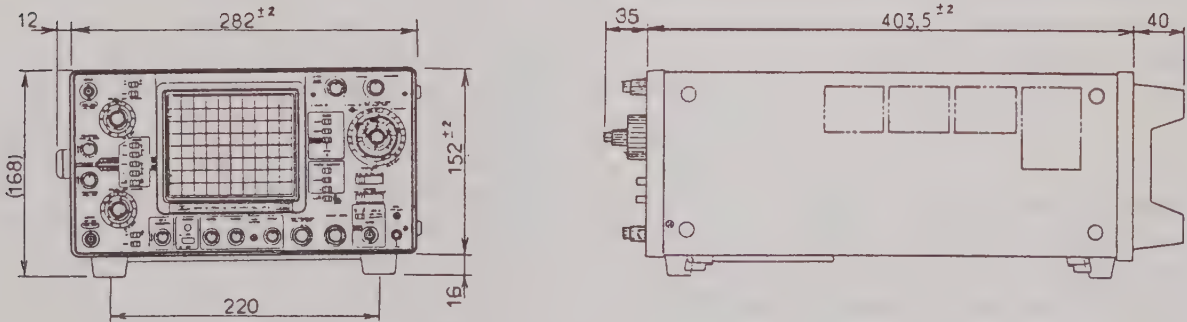
Weight	Approximately 7.2 kg
Dimensions	282 ±2 (W) x 152 ±2 (H) x 403 ±2 (L) (mm) See Figure 1-3-1.

1-4 ENVIRONMENTAL CHARACTERISTICS

Operating Temperature	0°C to 40°C
Operating Humidity	40°C, 90% Relative Humidity
Storage Temperature	-20°C to 70°C
Storage Humidity	70°C, 80% Relative Humidity

Altitude	Operating: 5,000 m maximum (atmospheric pressure 428 mm Hg) Non-operating: 15,000 m maximum (atmospheric pressure 87 mmHg)
Vibration	From 10 Hz to 55 Hz and back in 1 minute; double amplitude 0.63 mm; for 15 minutes each in vertical, horizontal, and longitudinal directions for a total of 45 minutes
Impact	One side is raised to an elevation angle of 30° (10 cm maximum), and let fall on a piece of hard wood. Each side is put to this test 3 times.
Drop	A package ready for transportation is dropped from a height of 90 cm.

Figure 1-3-1 Dimensional Diagram



NOTES

Circuit Description

2-1 GENERAL

The circuit for this oscilloscope consists of the components shown in Figure 2-1-1.

This section first describes the basic operation using the block diagram in Figure 2-1-1. Then functions and operations of each block are described in detail. Each block contains a circuit number (□) referring to the circuit diagrams at the end.

For similar circuits such as pre-amplifiers of CH1 and CH2 or pre-amplifier of CH3 and A synchronization signal amplifier, only the differences are described for the latter.

Note: Circuit Number

*Example For 1R01, the number **1** in front of parts number, which starts with R, is the circuit number.*

The vertical deflection system consists of three independent pre-amplifiers. With the combination of attenuator variable and magnifier, the input sensitivity for CH1 and CH2 can be set to 1 mV to 25 V per display scale division and CH3 can be set to 0.1 V per display scale division. The input signal applied to each of these channels is converted to balance signal, and amplified.

The vertical main amplifier deflects the electron beam scanning the phosphorus surface of the screen in the vertical direction (Y axis). It amplifies the signal according to the deflection sensitivity unique to the display tube so that the vertical input sensitivity of the oscilloscope corresponds to the display scale divisions.

On the other hand, the signal applied to the pre-amplifier is divided and passed to the SOURCE switch. CH1, CH2, CH3, and LINE (internal connection) are connected to the SOURCE switch. They are connected to the COUPLING switch when selected with the switch. Connected to the COUPLING switch are AC, DC, HF rejection, and TV synchronization separation circuit. A signal component is selected with a switch and passed to the trigger signal amplifier. The signal amplified by the amplifier is converted to a trigger pulse with a constant rise time and voltage by the waveform shaping circuit and passed to A and B-sweep generator.

When a trigger pulse is applied to the A-sweep generator, a sawtooth horizontal axis sweep signal is generated. The B-sweep generator generates sweep signals after the A-sweep generator has started. The sawtooth sweep generated by B is called a delayed sweep.

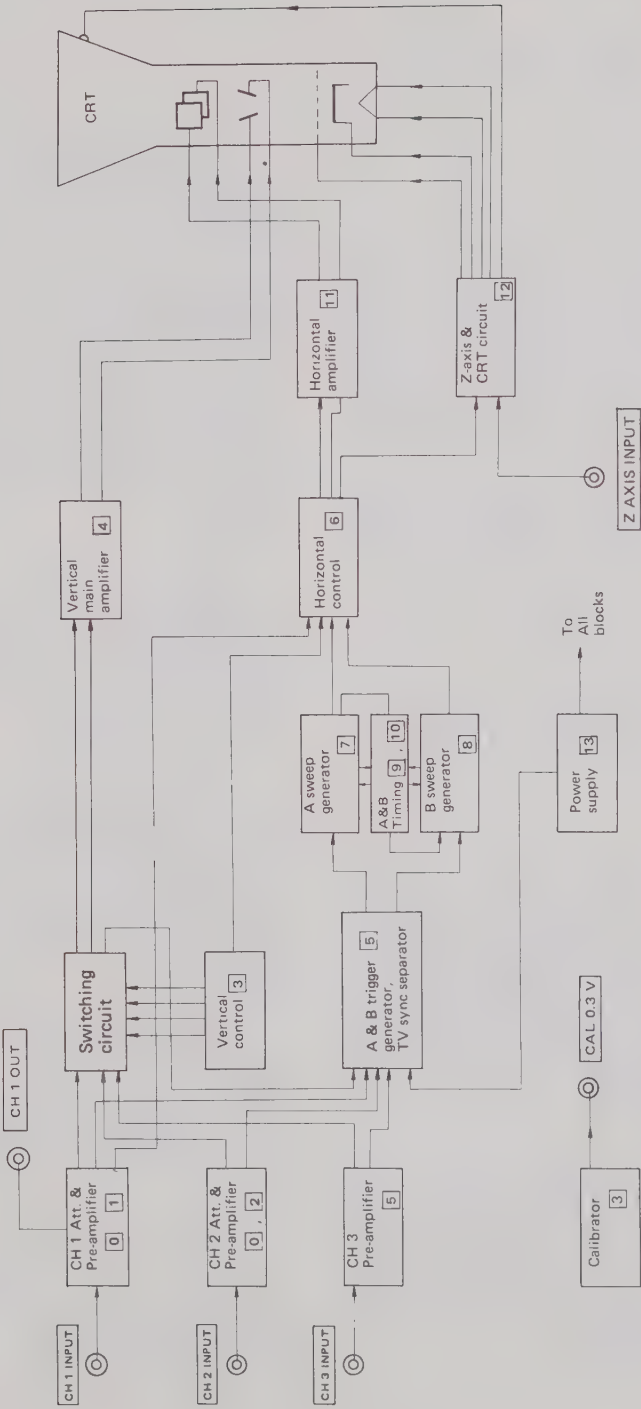
The horizontal amplifier deflects the electron beam scanning the phosphorus surface of the screen in the horizontal direction (X axis). It amplifies the sweep signal from A and B sawtooth generator according to the deflection sensitivity unique to the display tube so that it corresponds to the time axis division.

The Z-axis amplifier amplifies the sweep gate pulses from the A and B sawtooth generator and creates intensity modulation signal. The output pulse from the Z-axis amplifier is called an unblanking pulse because it increases intensity only during horizontal sweeps.

The CRT circuit consists of high voltage power source circuit for high speed scanning of electron beams, CRT electrode circuit for focusing, and a circuit for guiding unblanking signals to CRT.

The low voltage power source circuit provides constant

Figure 2-1-1. SS-5706 Overall block diagram



voltage sources to drive the circuits shown in Figure 2-1-1 from commercial power supply. It also supplies the power for display scale light, and line signals for synchronizing with commercial power.

The calibrator is a square wave generator which generates calibration voltage. This signal is used to adjust the probe phase and vertical input sensitivity.

2-2 VERTICAL AXIS

2-2-1 Vertical Axis Input and Attenuator (CH1 circuit numbers are used) [0], [1], [2]

The signal to be measured may be very low or very high voltage, AC current, DC current, or DC current superimposed upon AC current. In order to cope with these signals and obtain the best amplitude, an AC-GND-DC switch is provided to change the connection between the attenuator and input.

The AC-DC-GND switch selects the input connection type according to the signal applied to the connector.

When this switch is set to AC, the circuit 0C21 changes the vertical deflection system input to AC connection and removes the DC component and passes only the AC component.

When it is set to DC, the connection is changed to DC and all frequency components including DC component are passed.

When it is set to GND, the input signal and the attenuator are disconnected and the attenuator input is grounded. (The input signal is not grounded). Therefore, it is easy to verify the no signal reference voltage.

The attenuator can switch the sensitivity of the vertical deflection system from 5 mV/div to 10 V/div in 11 steps in a 1-2-5 sequence. Also, with the use of a VARIABLE control, attenuation can be increased 2.5 times or more and each range can be compensated linearly.

When the control is set to x5 MAG for 5 mV/div and 10 mV/div, sensitivity can be increased to 1 mV/div and 2 mV/div.

2-2-2 Pre-amplifier (CH1, CH2) [1], [2]

The CH1 and CH2 pre-amplifiers are as shown in Figure 2-2-1. The input signal passes through an attenuator and is applied to the impedance convertor 1Q01. The input impedance of the oscilloscope is 1 M Ω , but it is converted to low impedance output when the input impedance of the next step amplifier is high because it is difficult to handle high frequency signals.

The signals applied to pre-amplifier 1Q02, 1Q08, 1Q04, and 2Q05 are amplified and converted to balanced signals. When the vertical axis sensitivity is increased five times using x5 MAG, switch 1S03 is closed and the 1Q04 and 1Q05 common emitter is reduced to amplify five times. The previous step amplifier output is applied to the amplifier formed by 1Q12, 1Q13, 1Q18, and 1Q19 to further amplify and passed to the switching circuit.

On the other hand, the trigger signal and X-Y signal divide the pre-amplifier output, pass through 1Q11 and 1Q14 base ground amplifier, and are applied to emitter follower 1Q11 and 1Q12. This emitter follower is input to CH1 only and lowers the base impedance of 1Q07, 1Q08, 1Q15, and 1Q16. This is to prevent the unbalanced components of both transistors from affecting CH1 OUT and XY DC level when the SOURCE switch is switched and the collector output voltage of 1Q15 and 1Q16 are changed.

The CH1 trigger signal passed through the emitter follower passes through 1Q15, 1Q16, TRIG SOURCE switching circuits 1D20, 1D21, 1Q17, and 1Q23, and is output from 1Q20 and then passed to synchronization signal amplifier through SOURCE and COUPLING switches.

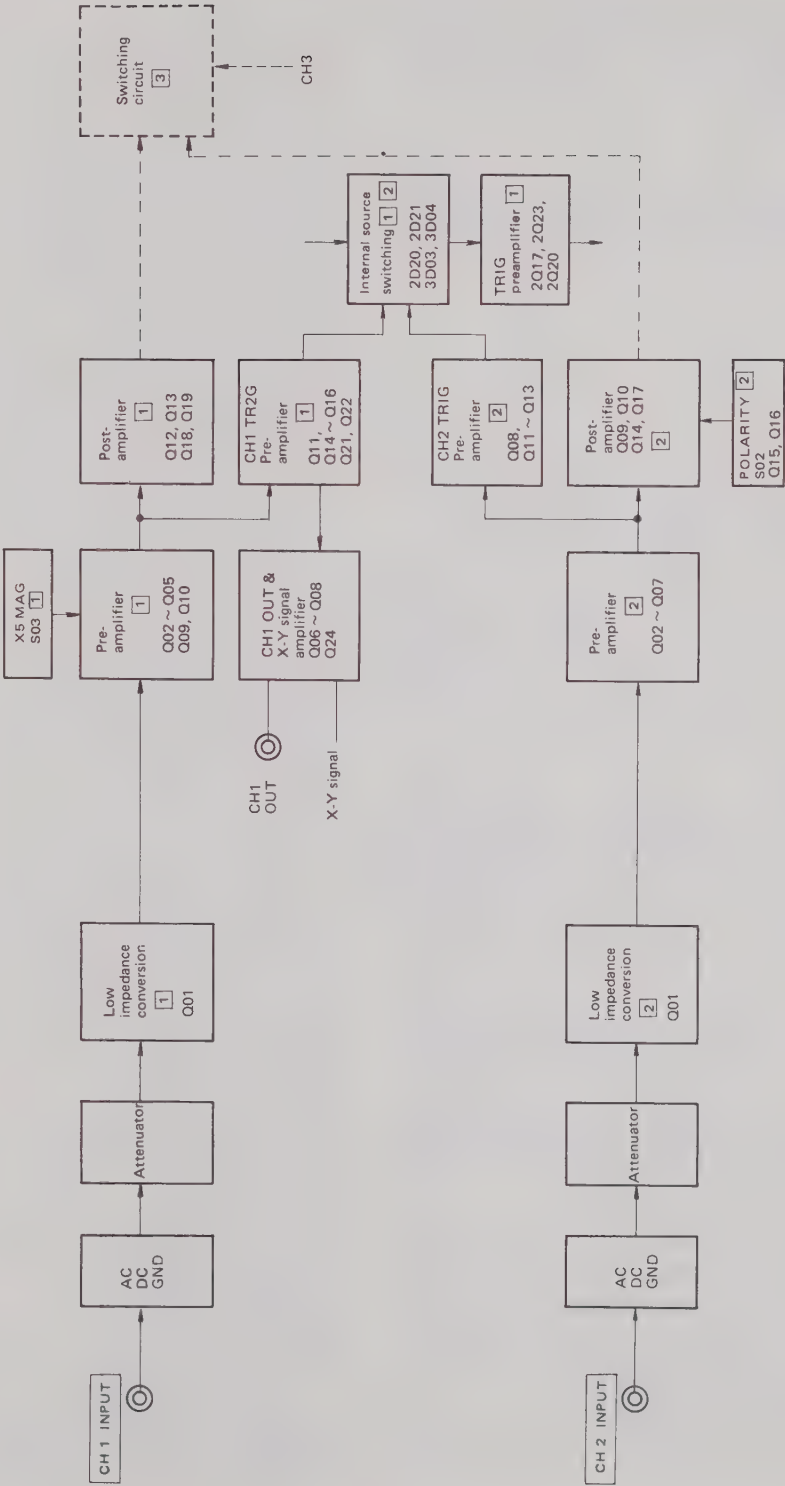
The CH1 OUT signal is passed through amplifiers 1Q07 and 1Q08, and output from 1Q06.

The X axis signal during X-Y operation divides the CH1 OUT signal, passes through 1Q24, and goes to HORIZONTAL CONTROL circuit.

POSITION enables the changing of vertical position of displayed waveform by changing the 1Q18 and 1Q19 emitter current with variable resistor 1R55.

CH2 POLARITY 2S02 enables the reversing of CH2 input signal polarity. Normally (NORM), signals are applied to 2Q14 and 2Q17 emitters and output from the collector

Figure 2-2-1. Block diagram of CH1 and CH2 pre-amplifier 1, 2



with the same polarity as the emitters. When set to INVERT, 2Q14 and 2Q17 become off and the signals are output from collector with the same polarities as the emitter applied to 2Q15 and 2Q16. The transferred signals are applied to the CRT deflectors with reverse polarity because the output signal is connected in reverse and passed to the switching circuit.

The CH2 synchronization signal is passed through 2Q08, 2Q11, 2Q12, and 2Q13, and then through TRIG SOURCE switching diodes 2D03 and 2D04, and passed through the same path as the CH1 synchronization signal.

2-2-3 Pre-amplifier (CH3) [5]

The CH3 pre-amplifier circuit is as shown in Figure

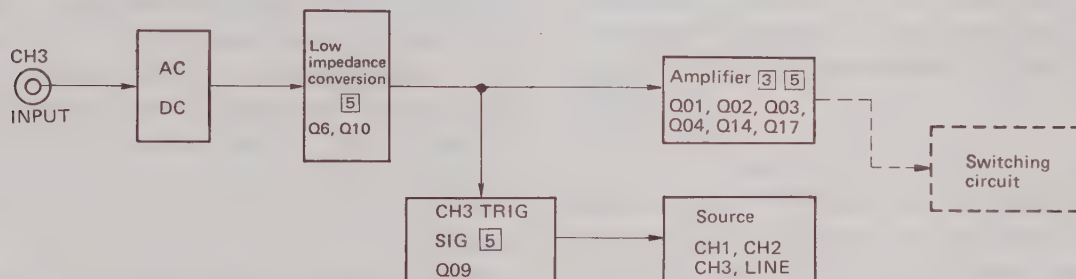
2-2-3. The input circuit operation and pre-amplifier functions are similar to CH1 and CH2. The difference is, only AC and DC switching is available without GND and there is no attenuator.

The input signal is passed through AC-DC switch and applied to the gate of impedance convertor 5Q06. It is converted to low impedance output by 5Q06, passed through emitter follower 5Q10 and 5Q17, passed to balanced type amplifier 3Q01, 3Q02, 3Q03 and 3Q04, and then the amplified signal is sent to the switching circuit.

The CH3 synchronization signal is divided at 5Q10 and provided to SOURCE switch and CH3 Trigger Circuit.

CH3 POSITION is a variable resistor 3R60 connected to the 3Q14 base of the balanced type amplifier and is used to change the vertical location of the CH3 displayed waveform.

Figure 2-3-3. Block diagram of CH3 pre-amplifier



2-2-4 Switching Circuit [3]

The switching circuit is used to selectively connect the signal set with the vertical axis mode switch to the main amplifier. Its basic operation is described next. Refer to Figure 2-2-5.

For example, when the vertical axis mode is set to CH1, low level voltage is passed through switching control 3IC03 to 3IC05 and applied to the common anode of 3D02 and 3D03 of CH1, and high level voltage is applied to other common anodes 3D06 and 3D07 of CH2, and 3D14 and 3D14 of CH3.

Therefore, 3D02 and 3D03 of CH1, for which low level voltage is applied, become reverse bias and are turned off and 3D01 and 3D04 are turned on with forward bias.

On the other hand, 3D06 and 3D07 of CH2 and 3D14 of CH3 for which high voltage is applied, become forward bias and turn on. 3D05 and 3D08 of CH2 and 3D11 and 3D12 of CH3 become reverse bias and turn off. Therefore, only signal from CH1 is passed to the amplifier.

Thus only channels with low level voltage applied to the switching diode of common anode are passed to the main amplifier.

a. ALT

When the vertical axis mode is set to ALT, alternate pulse (V MODE PLS) generated by the sweep generator and passed through H control and V control is input to switching circuit 3IC03. As for the switching signal output from 3IC03, the channel is switched for each sweep and

each signal is passed to the main amplifier.

This MODE is switched by a sweep gate signal and therefore, multiple traces cannot be observed simultaneously in the low sweep range.

Therefore, this is suited for observation of multiple traces when the signals to be measured are relatively high.

b. CHOP

When the vertical axis mode is set to CHOP, the signal generated by calibration oscillator 3IC01 is sent to the switching circuit through 3IC05. This oscillator uses a ceramic oscillator 3X01 and oscillates at 256 kHz. The signal sent to the switching circuit is applied to the clock input terminal of the flip-flop 3IC03. This flip-flop switches at the positive edge and the switching frequency is half the oscillating frequency or 128 kHz. The signal for each channel switched with this output is sent to the delay cable.

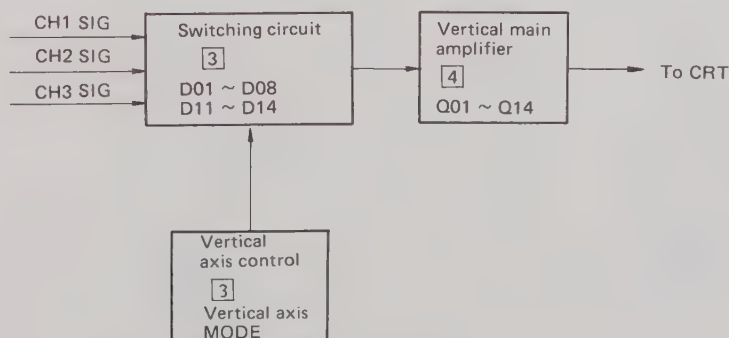
Fast channel switching can be performed in this manner even during sweep to enable easy observation of multiple traces when the measured frequencies are relatively low.

The chop blanking pulse is a trace elimination pulse which removes the instability when channels are switched. This pulse is passed through 3IC01 and sent to the Z-axis amplifier.

c. ADD

When the vertical axis MODE is set to ADD, the sum of signals applied to CH1 and CH2 (CH1 + CH2) is displayed on the CRT.

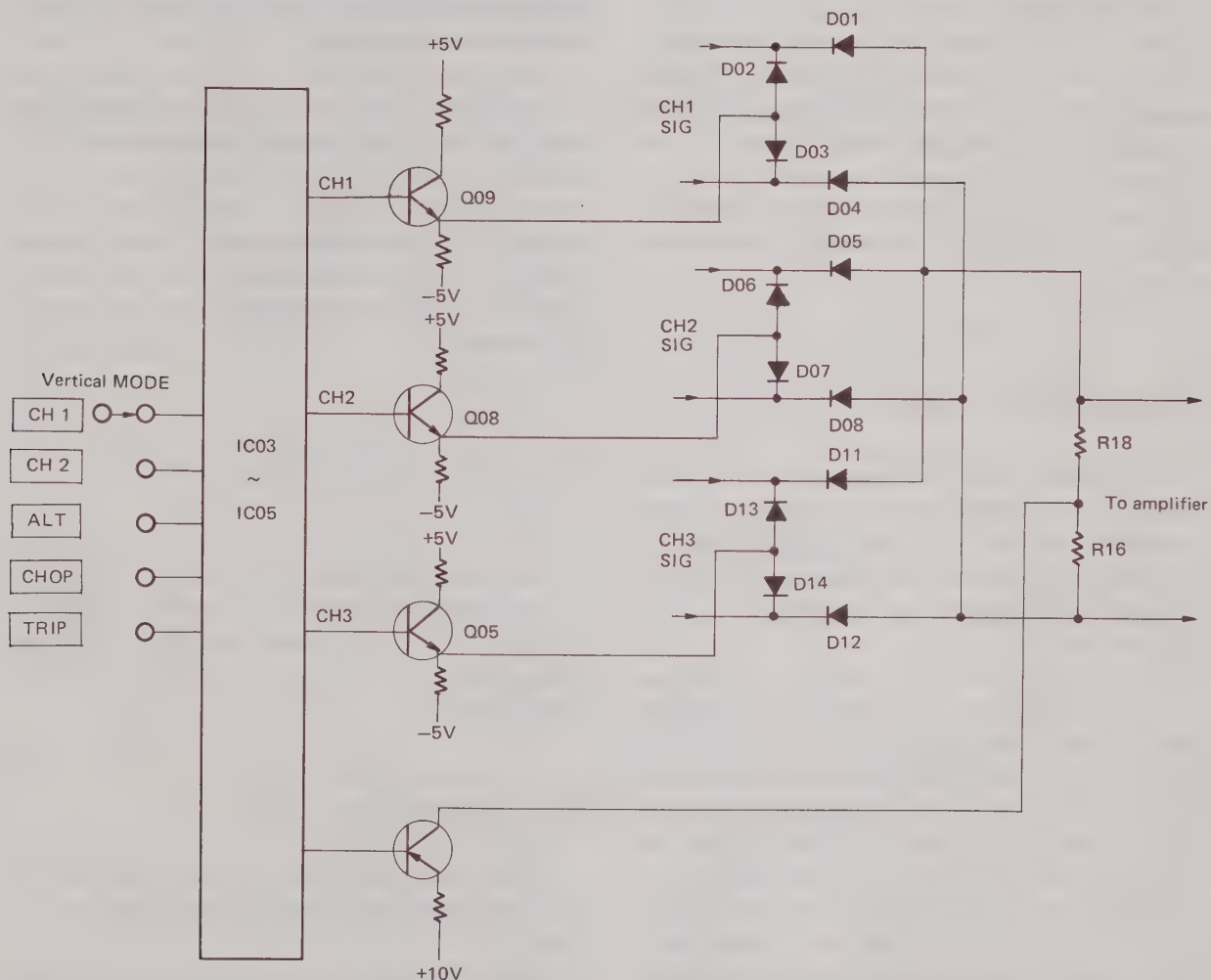
Figure 2-2-4. Block diagram of switching circuit [3] and vertical main amplifier circuit [4]



Because CH1 and CH2 are on together, the base voltage of switching circuits 3Q08 and 3Q09 are kept low and 3D02, 3D03, 3D06, and 3D07 are turned off. In this case,

because a two channel amplifier is connected, current for one channel is supplied through 3R16 and 3R18 by turning 3Q10 on.

Figure 2-2-5. Switching circuit 3



As a result, a signal for one channel is sent to delay cable driving amplifier and amplified. When CH2 POLAR switch is set to INV from this state, the polarity of input signal to CH1 is reversed and the switching circuit output is displayed on the CRT as the difference of signals applied to CH1 and CH2 ($CH1 + (-CH2)$).

d. TRI

When the vertical axis MODE is set to ALT or CHOP and then set to TRI, the multiple trace display of ALT and CHOP become triple trace observation and CH1, CH2, and CH3 input signals are displayed on the CRT.

In the case of triple trace observation with CHOP mode, the chop frequency is 1/3 of 256 kHz or approximately 85 kHz.

2-2-5 Vertical Main Amplifier [4]

This amplifier receives the output signal from delay cable with a terminating resistor, amplifies it to proper amplitude, and supplies it to the vertical axis deflector.

The outputs of the first level balance amplifiers 4Q01 and 4Q02 are connected to beam finder circuit and trace separator circuit.

The beam finder circuit is connected between the collectors of 4D10, 4D11, 4R17, 4R09, 4Q01, and 4Q02. When the beam finder is turned on, the control line is grounded and the above resistors and diodes are connected in parallel to 4R13 and 4R14 to attenuate the gain. This brings the beam that was outside the display to inside the display and enables easy verification of trace position.

The trace separation circuit enables the separation of vertical display position of A-sweep and B-sweep during alternate sweep. A beam separation gate pulse from anode of 4D03 is passed through 4D04 and input to the collector of 4Q01. A B-sweep beam level control signal is input to the base of 4Q15. This DC level is changed to change the DC level of the main amplifier during B-sweep through 4Q15 to enable the separation of the beam.

The last step is a totempole type negative feedback circuit consisting of 4Q03 to 4Q14, 4R10 to 4R12, 4C36, and 4D05 form a temperature compensation circuit with

high frequency characteristic. 4R24 and 4R31 are feedback resistors and the approximate gain is determined by emitter resistor 4R18. 4Q13, 4Q14, 4D08, 4R43, and 4R44 form a constant current circuit. 4D07, 4D08, and 4R34 are used to create base voltage bias for 4Q09 to 4Q14. 4R37 is a heat balance resistor for 4Q09, 4Q11, 4Q12, and 4Q14. 4Q06, 4Q07, 4R26, 4R28, 4C15, 4C16, 4R62, and 4R40 form a high frequency bypass circuit.

When a signal is input to 4Q03 and 4Q04, vertical deflection output signal is obtained from the collectors of 4Q09 and 4Q11. High frequency signal is inverted by the collectors of 4Q03 and 4Q04, passed through emitter followers 4Q06 and 4Q08, and converted to differential pulse by 4C15, 4R12, 4C16, and 4R4. This pulse is applied to 4Q13 and 4Q14 and improves frequency characteristics. 4L01 and 4L02 are peaking coils to improve frequency characteristics.

2-3 TRIGGER GENERATOR CIRCUIT

The trigger generator circuit consists of source signal for selecting synchronization signal source, coupling circuit to select synchronization signal component, amplification circuit, and a circuit to convert synchronized signal to trigger pulse.

2-3-1 Coupling Circuit [5]

The coupling circuit includes TV synchronization separation circuit which separates synchronization signal from TV signal.

The SOURCE switch is used to select the synchronization signal source. The signal applied to the vertical axis input is divided and connected to CH1, CH2, and CH3. When LINE is selected, the power line signal becomes the synchronization signal and enables observation of line frequency and its higher harmonics.

The COUPLING switch is used to select the method of connecting synchronization signal source and synchronization signal amplifier. When AC is selected, AC connection is

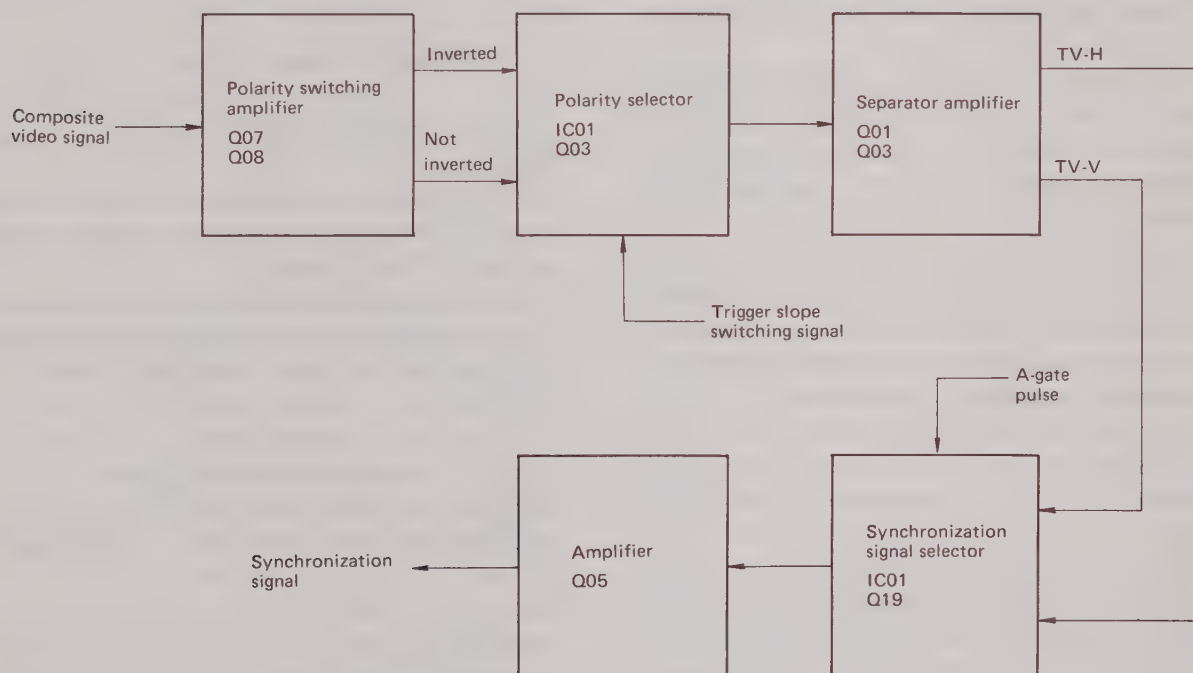
made and the DC component is suppressed with capacitor 5C13 so that synchronization is unaffected by DC component.

When DC is selected, DC connection is made and synchronization is performed with DC component.

When HF REJ is selected, a low pass filter is formed by 5R36 and 5C14 and frequencies exceeding 10 kHz are attenuated. Therefore this is suitable for observing signals

containing high frequency noise. When FIX is selected, the synchronization level is fixed so that synchronization is made without synchronization operation. When TV-H is selected, TV horizontal synchronization pulse is used to synchronize and composite video signal waveform can be observed for 1 H. When TV-V is selected, TV vertical synchronization pulse is used to synchronize and composite video signal waveform can be observed for 1 V.

Figure 2-3-2. Block diagram of TV synchronization signal separation circuit ⑤



2-3-2 TV Synchronization Signal Separation Circuit 5

The TV Synchronization signal separation circuit is as shown in Figure 2-3-2. This circuit separates and amplifies the synchronization signal component from composite video signal and then separates it into horizontal synchronization signal TV-H and vertical synchronization signal TV-V. The separated TV-V and TV-H signals are selected by a control signal from A-sweep generator and sent to synchronization signal amplifier.

When composite video signal is applied to the base of 5Q08, an inversed and amplified signal from the collector of 5Q08 is sent to the base of 5Q07 and pin no. 8 of polarity selector 51C01.

An inverted signal of signal from 5Q08 is obtained at the collector of 5Q07 and is passed to pin no. 11 of 51C01. The inverted and non-inverted composite video signals created by 5Q07 and 5Q08 are switched by a trigger slope polarity switching signal.

Pins number 10 and 11 of 51C01 are connected for positive slope and pins 8 and 9 are connected for negative slope and the synchronized signal component is always sent to the base of the next step amplifier 5Q03 so that the synchronization component is always positive.

The composite video signal is amplified at the collector of 5Q03 with the synchronization signal component having negative polarity and sent to the cathode of 5D01 and base of 5Q01.

The 5D01 clamps the video signal from the amplified composite video signal, uses the threshold level of 5Q01 to separate and amplify synchronization component and video signal component and sends them to the integration/differentiation circuit to separate TV-V and TV-H pulses.

The vertical synchronization signal TV-V is separated from the synchronization signal component by an integration circuit consisting of 5R11 and 5C02, and sent to pin number 4 of 51C01. On the other hand, the horizontal synchronization signal TV-H passes through a differentiating circuit formed by 5C03 and 5R12 and is sent to 51C01 pin number 1. The TV-V and TV-H signals sent to 61C01 are output from pins number 2 and 3 as follows by the switching signal A-GATE PULSE output from A-sweep generator.

- A-sweep generation circuit trigger wait time
TV-V synchronization signal
- B-sweep generation circuit trigger wait time
TV-H synchronization signal

The TV-V or TV-H signal output to pins 2 and 3 are passed to the base of 5Q05, amplified by the collector, passed through a coupling switch, and sent to the synchronization signal amplifier.

2-4 SWEEP SIGNAL GENERATION CIRCUIT

2-4-1 A-Sweep Generator Circuit 7 , 9

The A-sweep generator circuit is as shown in Figure 2-4-1-(1).

The sweep generator circuit is switched by horizontal axis MODE switch to perform AUTO operation, NORM operation, and SINGLE operation.

When horizontal axis mode AUTO is selected, the sweep generator synchronizes with the trigger signal and generates sweep signal when the trigger signals greater than 50 Hz is input. When there is no trigger signal or when the frequency is less than 50 Hz, sweep is started automatically after HOLD OFF time ends and auto sweep is performed.

When the horizontal axis mode NORM is selected, the sweep generation circuit sweeps when a trigger signal is input and stops sweep and waits when no trigger signal is input.

When the horizontal axis mode SINGLE is selected, the sweep generation circuit waits for a trigger and when a trigger signal is input, synchronizes, performs one sweep, and ends. When the SINGLE (RESET) switch is pressed, it reenters trigger wait.

The sawtooth waveform generated by these steps is passed through signal selection circuit of H-CONTROL circuit, passed through horizontal axis amplifier, and applied to the horizontal deflector of the CRT. Also, it is sent to B-sweep generation circuit in order to create delay pulse for B-sweep generation.

Figure 2-4-1-(1) A-sweep signal generation circuit 7, 9

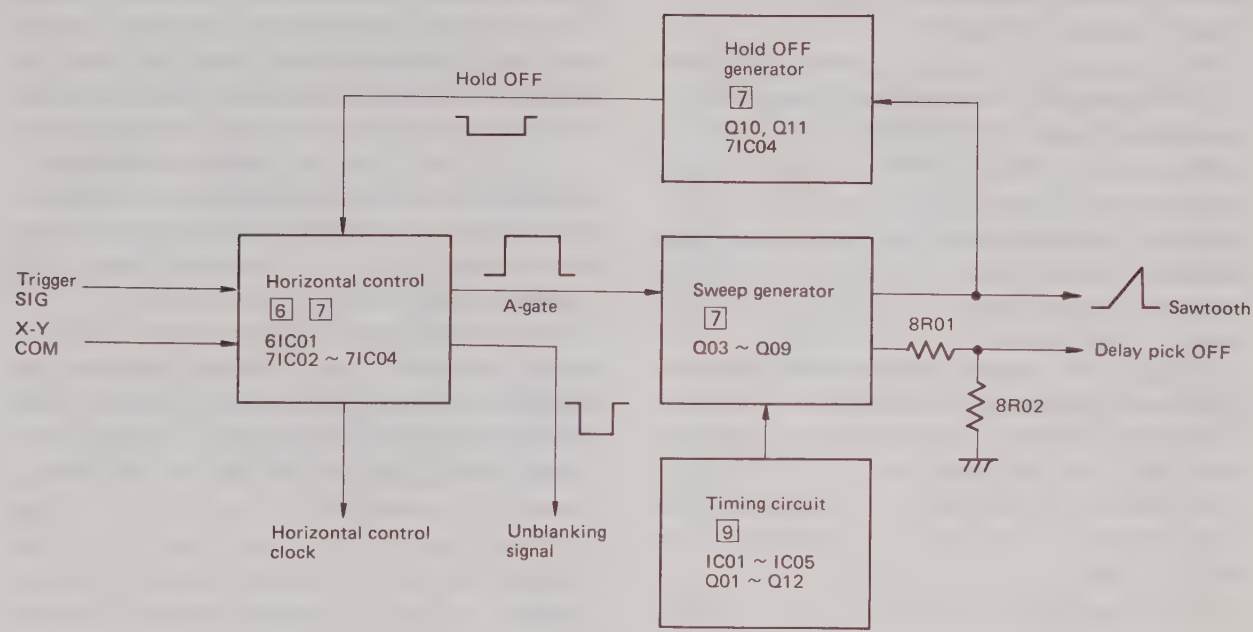
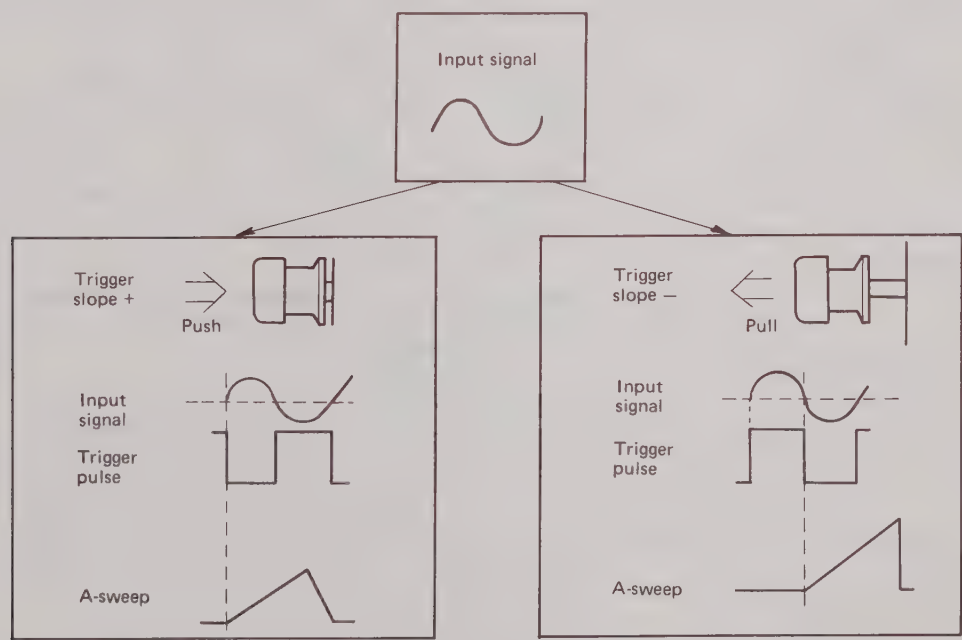


Figure 2-4-1-(2). Trigger slope setting and generation circuit synchronization



The gate waveform for creating sawtooth waveform is used as unblanking signal. This signal is sent to Z-axis amplifier and applied to the CRT.

Also, the sweep switch clock (2 SW) is the clock of the input switch circuit of the horizontal amplifier and is supplied from the H-CONTROL circuit.

The A-sweep generation circuit starts sweep at the fall of the trigger pulse converted to TTL level. During this, the relationship between the trigger slope setting for the input waveform and sweep generation circuit synchronization is as shown in Figure 2-4-1-(2) and the timing chart is as shown in Figure 2-4-1-(3).

The sweep signal generation circuit controls the start and end of sweep with sweep controller 71C03.

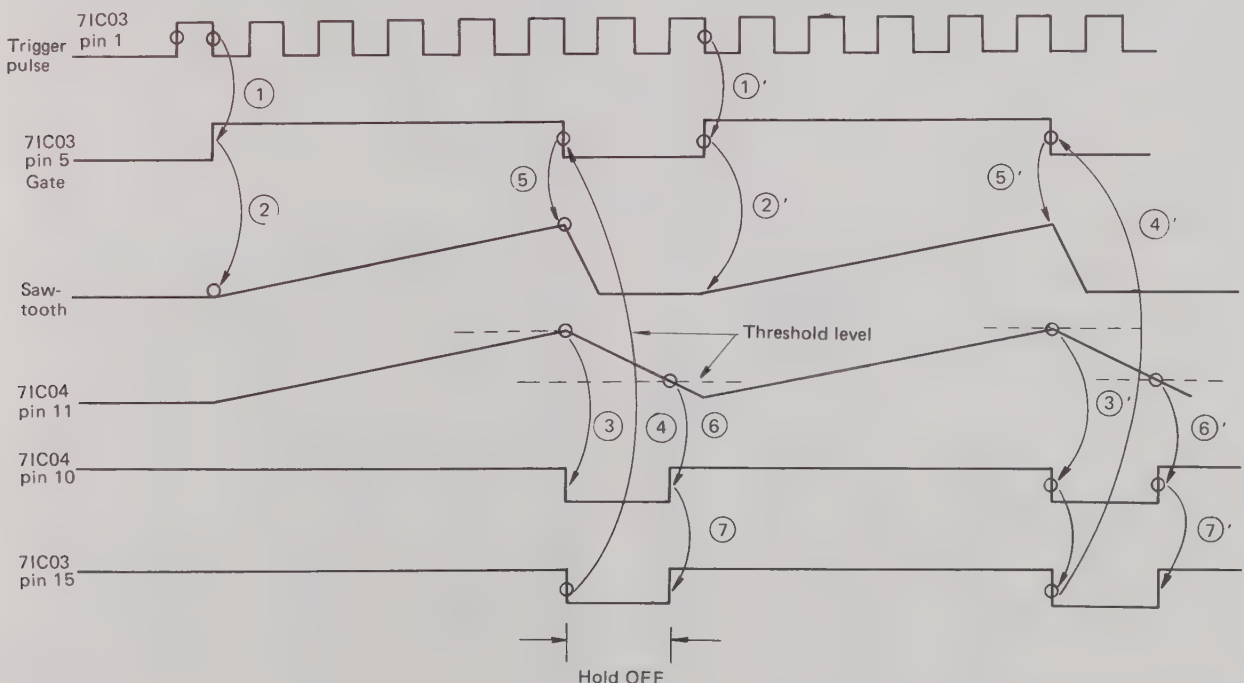
When set to AUTO, the 71C03 switches between automatic sweep and single sweep with output from 71C01. 71C02 controls the auto sweep low frequency limit and enables jitterless operation when the trigger pulse is a high frequency pulse.

In the sweep signal generation circuit, when the output

from 71C03 pin number 5 is high, the disconnect switch 7Q04 is turned off, reverse bias is applied to disconnect diodes 7Q05 and 7D02, and the timing capacitor is charged with timing current from A-timing circuit [10]. The capacitor terminal voltage forms a sawtooth sweep waveform that passes sweep signal generator buffer amplifiers 7Q07 and 7Q08, and goes to horizontal amplifier input switch H-CONTROL [7] and 8 sweep generation delay pulse generator. At the same time, this sawtooth waveform passes through sweep generator 7R24, 7R25, and buffer amplifier 7Q10, and charges the HOLD OFF capacitor.

The terminal voltage of the HOLD OFF capacitor is applied to buffer amplifier 7Q11 and comparator 71C04. When the voltage of the sawtooth waveform reaches approximately 14.5 volts, pin number 11 of the comparator 71C04 reaches approximately 1.7 volts, the output from pin number 10 is changed to low, resets 71C03 in the control unit, and inverts the sweep gate to low. When the gate signal becomes low, the disconnect switch on the sweep generator is turned on, the timing capacitor is discharged

Figure 2-4-1-(3). Sweep generator timing chart signal changes from (1) to (7).



through disconnect diode, and the output from buffer amplifier 7Q07 and 7Q08 returns to the start level of this sawtooth waveform. The sweep start comparator 7Q09 feeds back the buffer amplifier output to disconnected amplifier, discharges the timing capacitor terminal voltage to constant level (start level), and maintains that level. This completes a sweep.

On the other hand, the charges of the HOLD OFF capacitor accumulated during sweep are discharged through 9R28 and 7R37. At the same time, the setting of 7IC03 through buffer amplifier 7Q11 and comparator 7IC04 is prohibited. This is done to obtain the time to prepare for the next sweep and sweep does not start when a trigger pulse is input during HOLD OFF. This time can be changed up to four times by using the 7R37 [HOLD OFF] control.

When the horizontal MODE is set to SINGLE, pin

number 3 (J) of sweep controller 7IC03 is controlled so that sweep is inhibited after one sweep and does not become ready to receive trigger until SINGLE/RESET is pressed once more.

Pin number 3 of 7IC03 is controlled by the R-S flip-flop formed by 6IC01 of H-CONTROL circuit [6]. Sweep end signal is sent from A-sweep generator to pin number 4 (reset) of R-S flip-flop (6IC01). When the sweep ends, output pin number 12 (Q) becomes low, the signal is sent to 7IC03 pin number 3, and sweep is inhibited. When SINGLE/RESET switch is pressed, set pulse is sent to pin number 1 of 6IC01 to set R-S flip-flop and make output pin number 12 (Q) high, and then sent to pin number 3 of 7IC03 to make the sweep generator ready to receive trigger signals.

2-4-2 B-Sweep Generator Circuit 8 10

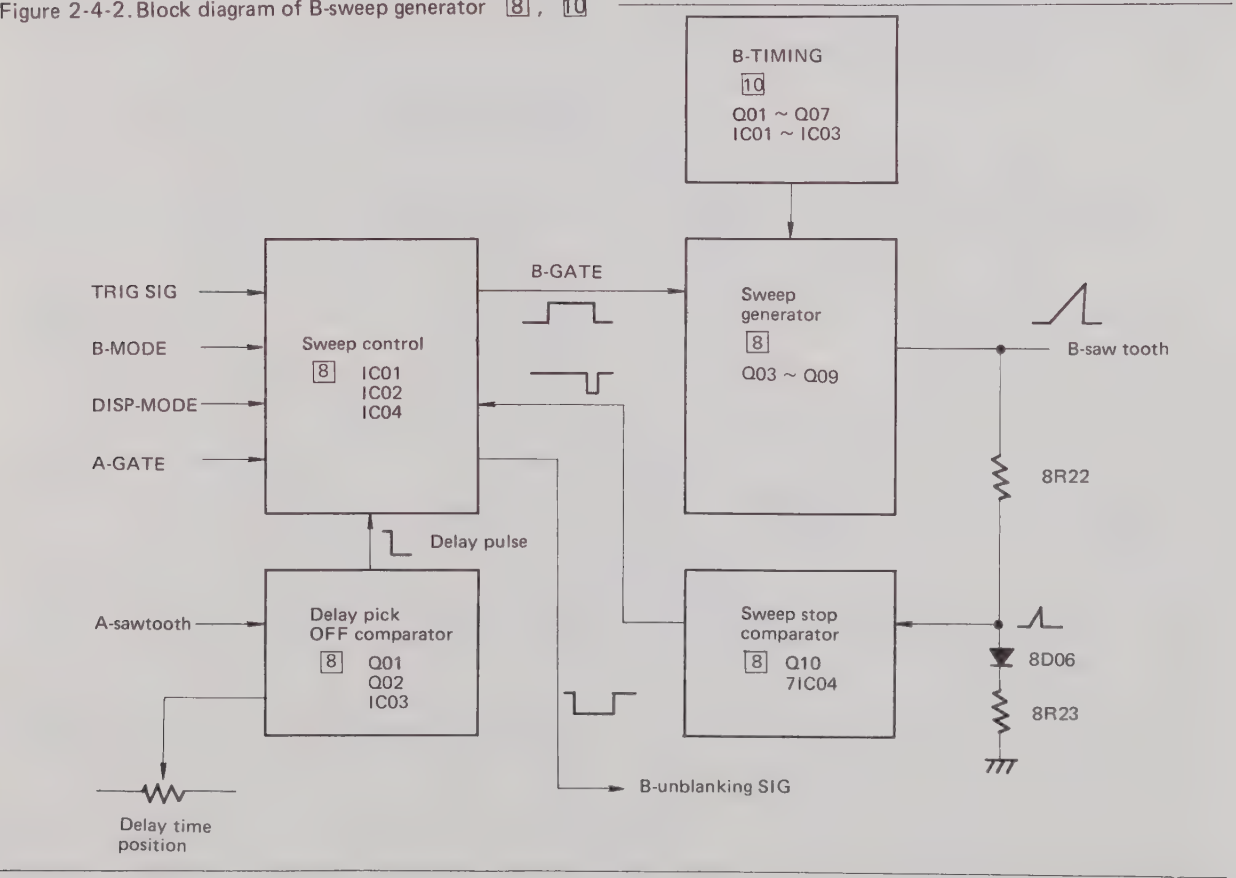
The B-sweep generator is as shown in Figure 2-4-2. In the explanation below, operations identical to A-sweep generator are omitted and only operations unique to B-sweep generator are described.

The B-sweep generator operates when the horizontal axis DISPLAY is set to A-INTEN, ALT, and B.

The B-sweep generator starts sweep a certain interval (delay time) after A-sweep generator starts. The delay time is determined by A-TIME/DIV and DELAY TIME POSITION settings.

When B-MODE is set to synchronized delay, a delay pick off pulse is applied to horizontal control and after delay time has elapsed, B-sweep is started by the first synchronized signal that arrives. When RUNS AFTER DELAY is set, sweep starts as soon as delay pick off pulse is applied.

Figure 2-4-2. Block diagram of B-sweep generator 8 , 10



2-5 H-CONTROL 6

The H-CONTROL circuit is as shown in Figure 2-5-1. It selects signals to horizontal amplifier and controls Z axis amplifier and trace separation according to switch settings.

A, A-INTEN, B, and ALT settings on H-DISPLAY are used to create A-COM (command), INT-COM, and B-COM control signals. The relationship between each setting and control line is shown in Table 2-5-1. The control signal is sent to B-sweep generator controller, Z-axis controller, and vertical axis switching signal selector.

Table 2-5-1

H-DISPLAY Setting	Control Line		
	A-CM	INT-CM	B-CM
A	Hi	Hi	Low
A-INT	Hi	Low	Low
B	Low	Hi	Hi
ALT	Hi	Low	Hi

The H-MODE push button switches are used to set AUTO, NORM, SINGLE/RESET; control free-running sweep of A-sweep generator; and control trigger wait and sweep inhibit when single sweep is selected. It also activates the relay that fixes the trigger level and makes an AC connection when both AUTO and NORM switches are pressed.

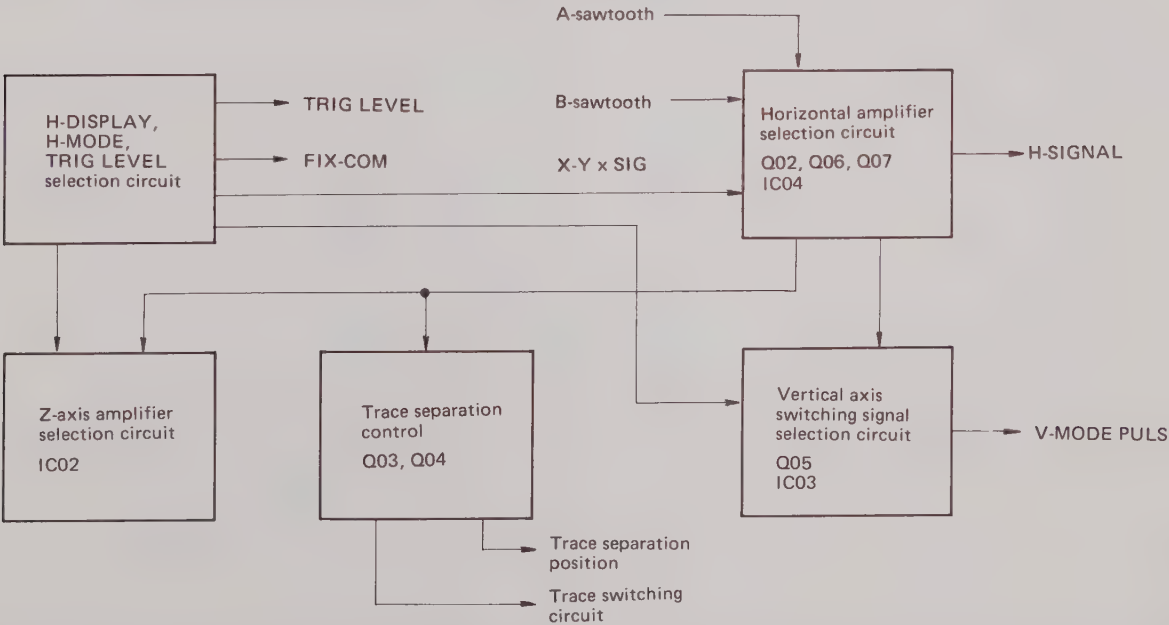
2-6 HORIZONTAL AMPLIFIER 11

The Horizontal amplifier is as shown in Figure 2-6-1. This amplifier amplifies the H-signal of the A-sweep, B-sweep, or X-Y signal selected by the H-CONTROL and sends it to the CRT horizontal deflector.

The signal sent to the base of 11Q01 in the first step of the horizontal amplifier is amplified and output from the collector. On the other hand, H-POSITION control is connected to the base of 11Q02 and DC voltage between 4 and 12 volts is output from the collector according to the position of the H-POSITION control.

The outputs from 11Q01 and 11Q02 are connected to the base of the differential amplifier formed by 11Q05 and 11Q06. A GAIN switching relay to obtain x 5 magnification is connected between the emitters of 11Q05 and 11Q06 and when the FINE Knob is pulled, the relay turns on, 11R16, 11R17, and 11R18 are connected to the emitters and gain is magnified ten times. The emitter currents for 11Q05 and 11Q06 are supplied by the constant-current circuit 11Q07. The signal sent to the base of

Figure 2-5-1. Horizontal control circuit 6

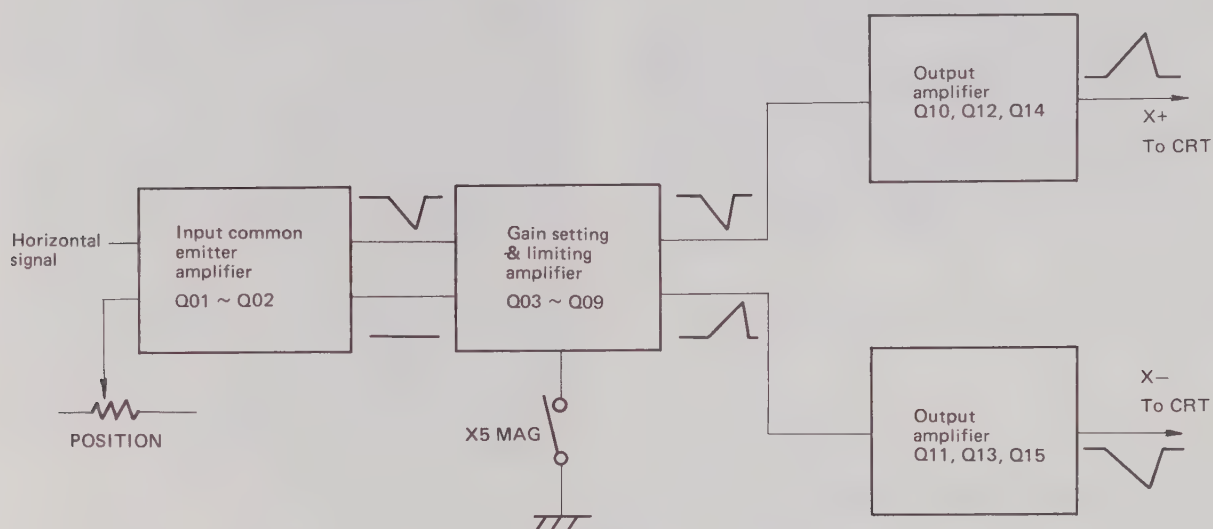


11Q05 is output from the collectors of 11Q05 and 11Q06 as signals with opposite polarity. Because the current source for 11Q05 and 11Q06 is a constant current source, the amplified signal voltage is limited to 12 Vp-p and is sent to the bases of 11Q08 and 11Q09.

The signal amplified by 11Q08 and 11Q09 is sent to the

bases of output amplifier 11Q10 and 11Q11. The output amplifiers 11Q10 to 11Q15 amplify the signal from the previous step so that its amplitude is sufficient for deflecting the CRT beam in the horizontal direction and send it to the horizontal deflector.

Figure 2-6-1. Horizontal amplifier 11



2-7 AXIS AMPLIFIER AND CRT CIRCUIT

The Z-axis amplifier and the CRT circuit are as shown in Figure 2-7-1.

2-7-1 Z-Axis Amplifier 12

The Z-axis amplifier consists of 12Q02, 12Q04, 12Q06, and 12Q08. It performs the following functions:

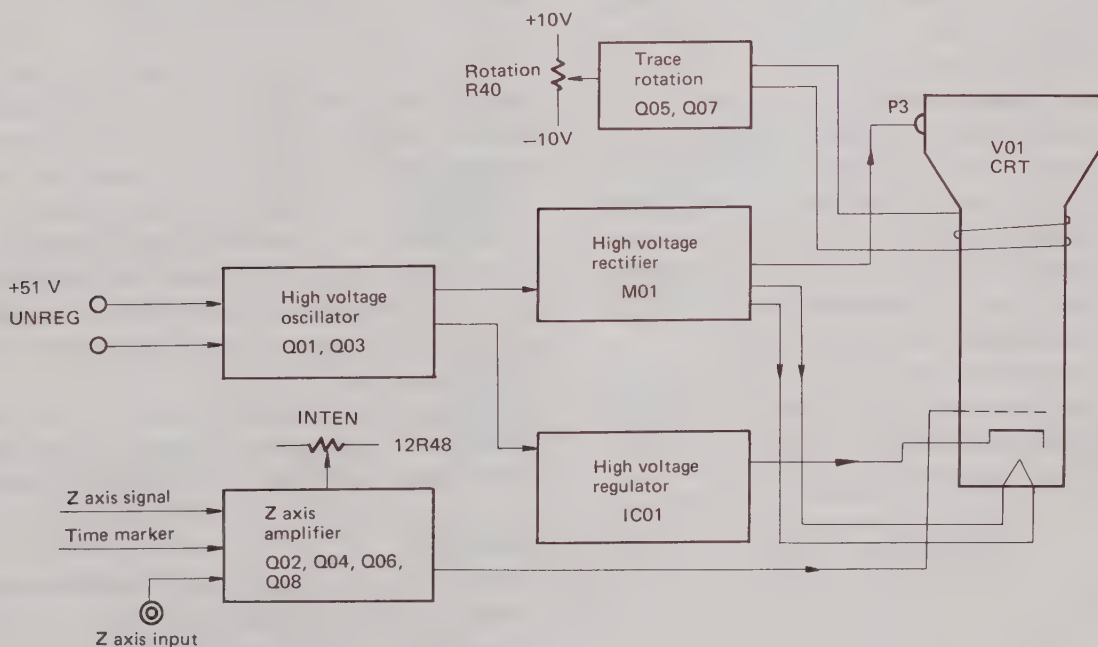
- Amplifies the sweep gate signal (unblanking pulse) that illuminates the CRT during A- and B-sweep and clears the CRT during flyback time.
- Amplifies the chop blanking signal used to erase the channel switching time transient that appears when the vertical axis mode is set to CHOP.

- Amplifies Z-axis input signal (external intensity modulation signal).
- Controls the intensity of the sweep line with INTEN.

The signal input to the Z-axis amplifier is sent to the emitter of 12Q02, 12Q02 is a base ground type amplifier with low input impedance and 12D10 and 12D11 function as limiting circuit so that 12Q06 and 12Q08 do not become saturated.

12Q02, 12Q04, 12Q06, and 12Q08 form a negative feedback type amplifier and the amplified signal is output from the collector of 12Q06. 12C08 is a speed increasing capacitor and the signal is differentiated by 12R26 and 12R29 and applied to the base of 12Q08 to improve the rise of output blanking signal. The output signal is sent to the grid of the CRT.

Figure 2-7-1. Block diagram of Z-axis amplifier and CRT circuit 12



2-7-2 CRT Circuit 12

The CRT circuit generates the high voltage used for the bias voltage of each CRT electrode in order to display a clear signal.

Various bias voltages between 30 V and 10.5 kV are applied to the CRT.

The high voltage oscillator circuit consists of 12Q01, 12Q03, and the primary winding of 12T01. A positive feedback is applied to 12Q03 from the collector winding of oscillating transformer 12T01 through the base winding. 12Q03 oscillates at approximately 40 kHz and generates a high voltage in the secondary winding. 12Q01, 12R06, supply the base current of 12Q03. 12D09, 12D21, and 12R12 form a protective circuit so that the negative withstand voltage between the base and emitter of 12Q01 is not exceeded.

The error amplifier circuit 12IC01 controls the 12Q01 base so that the high voltage generated by the high voltage oscillator can keep the CRT cathode voltage at -1.75 kV regardless of the change in intensity or primary winding voltage. This circuit consists of 12IC01, 12R14 to 12R17, and 12R41, 12R42, 12R43, 12R18, and 12R19 that use $+10$ V as base power source.

The high voltage rectifier circuit is composed of a 12-times voltage rectifier (for supplying $+10.25$ kV to the third anode P3 of CRT), M01, cathode voltage generation rectifying circuit 12C05, 12D15, 12D14, 12C10, 12C10, first grid voltage generation circuit 12C12, 12D19, 12D18, 12C11, 12R25, and 12C06. Also included is a heater voltage circuit from pins 5 and 6 of FOCUS, ASTIG, and GEOMETRY electrode circuit 12T01.

TRACE ROTATION consists of 12Q05, 12Q07, 12R35, 12R40, and rotation coil 12L01. The rotation coil is attached to the neck of the CRT and adjusts the electron beam angle with a magnetic field.

2-8 POWER SUPPLY

The constant voltage power supply is as shown in Figure 2-8-1. It consists of five power sources that supply constant power to each circuit. This circuit provides constant output voltage even when the load changes. Ripple is small and a protective circuit is provided to protect the constant power source circuit from damage when the output is grounded.

When power switch 13S01 is turned on, the power is supplied through a fuse to the power supply selecting plug. The power supply selection plug uses the two primary windings of the power supply transformer 13T01 to enable the selection of 100 V, 115 V, 220 V, 230 V, or 240 V.

The -10 V power supply circuit supplies the reference voltage for other power supplies (except $+5$ V power supply). The $+10$ V and -10 V secondary winding output voltages of the transformer are full-wave rectified by rectifier 13D01 and smoothed by capacitors 13C01 and 13C02 and changed to DC current. The positive and negative smoothed output voltages are sent to $+10$ V series regulator circuit and -10 V series regulator circuit respectively.

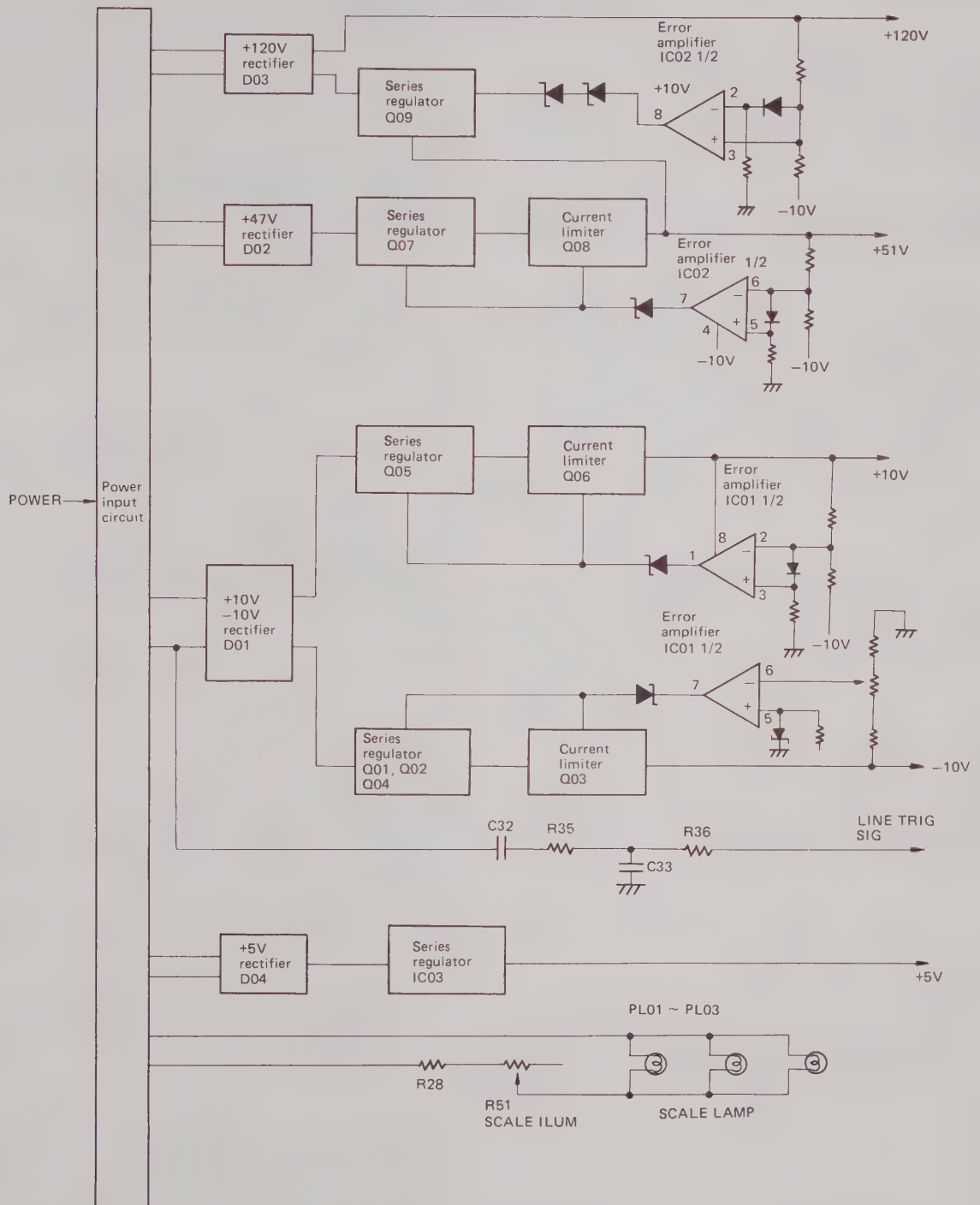
The $+5$ V power supply circuit supplies the secondary winding output voltage to rectifier 13D04, full-wave rectifies it, smooths it with capacitor 13C05, and sends it to 13IC03. 13IC03 is a three terminal regulator and outputs a $+5$ V constant power supply voltage with a single IC.

The $+10$ V, $+51$ V, and $+120$ V power supply circuit uses the -10 V constant power supply voltage as reference and outputs the respective constant voltage. The structure and operation of these circuits are the same as -10 V power supply circuit.

The scale lamp uses the secondary winding output voltage and drops it to approximately 6.3 V by 3R28 to illuminate the CRT scale. The brightness of the lamp can be adjusted with the SCALE ILLUM variable resistor 13R51.

The line trigger signal is sent from the secondary winding output to the synchronization signal generator circuit through 14C32, 14C33, 14R35, and 14R36.

Figure 2-8-1. Block diagram of power supply 13



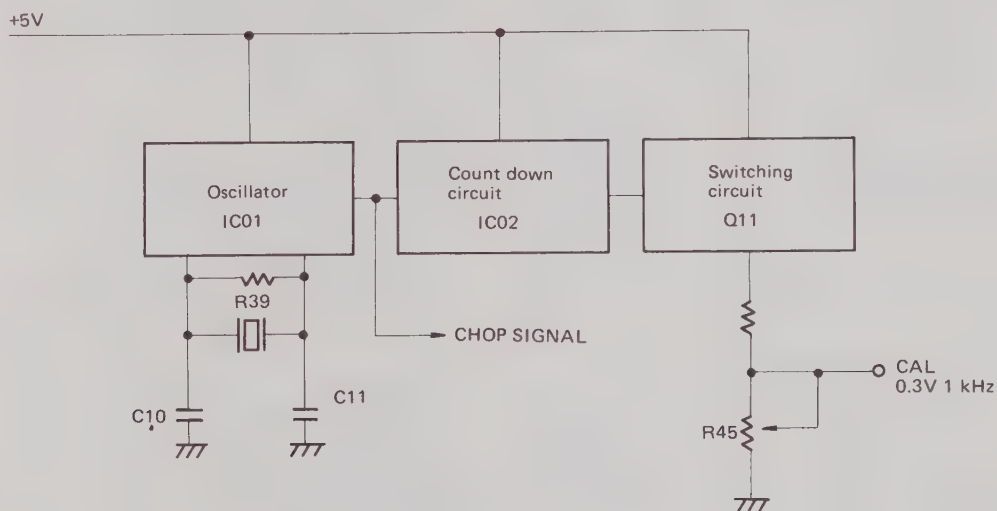
2-9 CALIBRATOR 3

The calibrator circuit is as shown in Figure 2-9-1. It repeatedly outputs 0.3 V, 1 kHz square wave. The output voltage is used mainly for vertical axis deflection sensitivity calibration, probe phase adjustment, and timing adjustment.

The calibrator 3IC01 forms an oscillator with 3R39, 3X01, 3C10, and 3C11. The frequency of the oscillator is

determined by the ceramic oscillating element 3X01. The 256 kHz signal is output from pin number 12 of 3IC01, passed through inverter buffer, and separated into CHOF switching signal and CAL signal. The CAL signal is passed through count down IC 3IC02, divided by 256, and output as a 1 kHz signal. This output signal is passed through 3R42 and switched by 3Q11 using the +5 V constant power supply. Then it is divided by 3R45 and 3R36 and output from CAL terminal as 0.3 V (1 kHz) signal.

Figure 2-9-1. Block diagram of calibrator circuit 3



Maintenance

This section describes the maintenance procedures for keeping the SS-5706 in good condition over a long period of time. If it becomes necessary to check and replace the circuit parts, refer to the Circuit Arrangement Diagrams.

Apart from the instructions given in this section, the proper operation procedures described in section 2 must also be observed to assure long satisfactory operation.

3-1 PREVENTIVE MAINTENANCE

These are the preventive maintenance procedure for preventing troubles and keeping your oscilloscope clean and well for a long period of time.

3-1-1 Cleaning

The extent of dirt varies according to the ambient condition in which the instrument is used. The instrument should be cleaned as required. Dirt accumulated in the instrument causes overheating because it interrupts effective heat dissipation. It also damages the parts under high-humidity condition. A dirty switch contact or connector can cause faulty contact, and dirt accumulated on the inner circuit part can cause spark during the wet season.

The fluids suitable or unsuitable for cleaning the instrument are shown in table 3-1-1.

Table 3-1-1

Suitable fluids	Alcohol, water, neutral detergent
Unsuitable fluids	Acetone gasoline, ether, lacquer thinner, methylethyl ketone, chemicals containing ketone detergent

Cover Cleaning

Remove the covers, and clean them with detergent. Remove stains of grease using a soft cloth dampened with one of the suitable fluids shown in Table 3-1-1.

Front Panel Cleaning

Wet a soft cloth with one of the suitable fluids shown in table 3-1-1, and clean the front panel with it. If alcohol is used, some traces might be left. The front panel can also be cleaned with detergent. In this case, it is necessary to wipe off the detergent left on the panel and the control knobs with a cloth dampened with water.

Inside Cleaning

The best way of cleaning the dirt accumulated in the instrument is to use an air compressor. Dirt which remains after blowing with air compressor can be removed by using a soft paint brush and blowing again with air compressor.

CRT and Filter Cleaning

The CRT screen and the filter can become dirty if they are used for a long time. Ordinary stains and fingerprints can be removed by wiping with a soft cloth. If they are terribly dirty, use a soft cloth dampened with alcohol.

3-1-2 If Unused for a Long Time

If you don't use the instrument for a long time, remove the probe, adaptor, etc. From it and put them in the supplied bag. Attach the supplied panel cover to it, put the dust cover on the oscilloscope, and store it in a place as dry as possible.

This can keep the instrument clean.

3-1-3 Checking

Inspect the inside of the instrument periodically for burnt resistors, faulty contacts, or damaged printed circuit boards. Major troubles can be prevented by repairing them immediately.

3-1-4 Periodic Adjustment

Periodic inspection and adjustments are necessary for keeping the instrument in accurate operating condition at all times. If the instrument is continuously used, inspect and adjust it about every 1000 hours. If it is not used so much, it may be inspected and adjusted about every six months.

3-1-5 Maintenance Aids

The maintenance aids listed in Table 3-1-5 include items required for performing most of the maintenance procedures in this instrument.

Table 3-1-5 Maintenance aids

Description	Specification	Usage
1. Soldering iron	15 to 25 W	General soldering and unsoldering
2. Crossdriver	2.6 mm, 3 mm	Assembly and disassembly
3. Torquedriver	2.5 kgf-cm	CRT replacement
4. Nutdriver	3 mm, 11 mm, 13 mm	Assembly and disassembly
5. Hexagonal wrench	3 mm	Knob replacement
6. Vacuum solder extractor	No static charge retention	Unsoldering static sensitive devices and components
7. Spray cleaner	No-noise	Switches cleaning

3-2 REMOVAL AND REPLACEMENT INSTRUCTIONS

PRECAUTION

To avoid electric shock, disconnect the instrument from the ac power source before removing or replacing any component or assembly.

3-2-1 Cover Removal

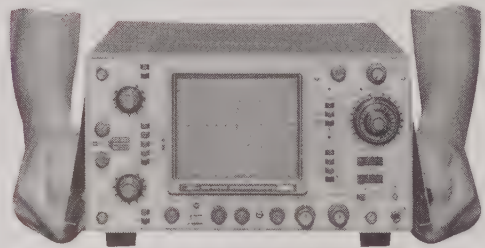
The covers must be removed before inspecting the inside or replacing faulty parts.

Be sure to remove the rear panel first in removing the covers. The rear panel can be removed by removing one each screws on the right and left of the panel. Then, remove the five screws from the top, left, and right sides of the top cover, and remove the cover by pulling it rear ward. (The front end of the top cover is inserted in a ditch behind the front panel.)

Remove one each screw in the front and rear parts of the bottom cover, and remove the bottom cover by pulling rearward. (The front end of the bottom cover is inserted in a ditch behind the front panel).

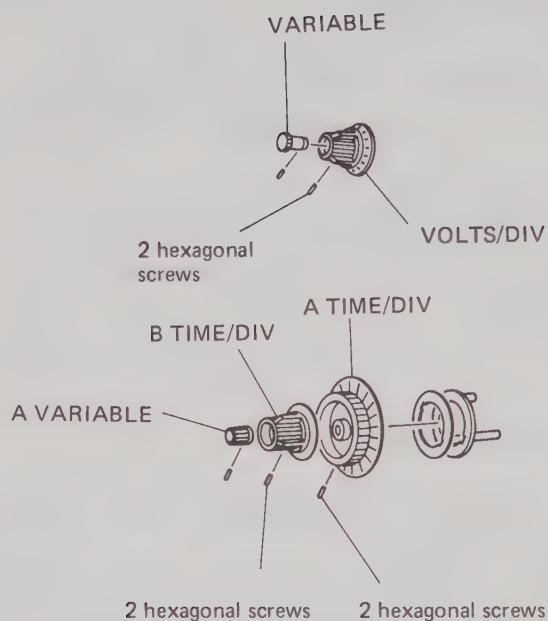
NOTE

When removing or attaching the top cover, widen on both edges of the cover as shown in the figure below.



3-2-2 Knobs Replacement

- (a) The knobs VOLTS/DIV, VOLTS/DIV VARIABLE, A and B TIME/DIV, A VARIABLE, and $\leftrightarrow$ POSITION FINE are all held with hexagonal screws. To remove the knobs, remove the hexagonal screw and pull.
- (b) All other knobs can be removed just by pulling.



3-2-3 Printed Circuit Board Replacement

Left Side

(a) PREAMP Board (ATTENUATOR [0], CH1-CH2 PREAMP [1][2], V CONTROL [3])

1. Remove CH1-CH2 VARIABLE and VOLTS/DIV knobs on the front panel.
2. Remove the nuts holding the CH1 and CH2 VOLTS/DIV switches.
3. Remove the connectors attached to this board.
4. Remove the six screws holding this board.

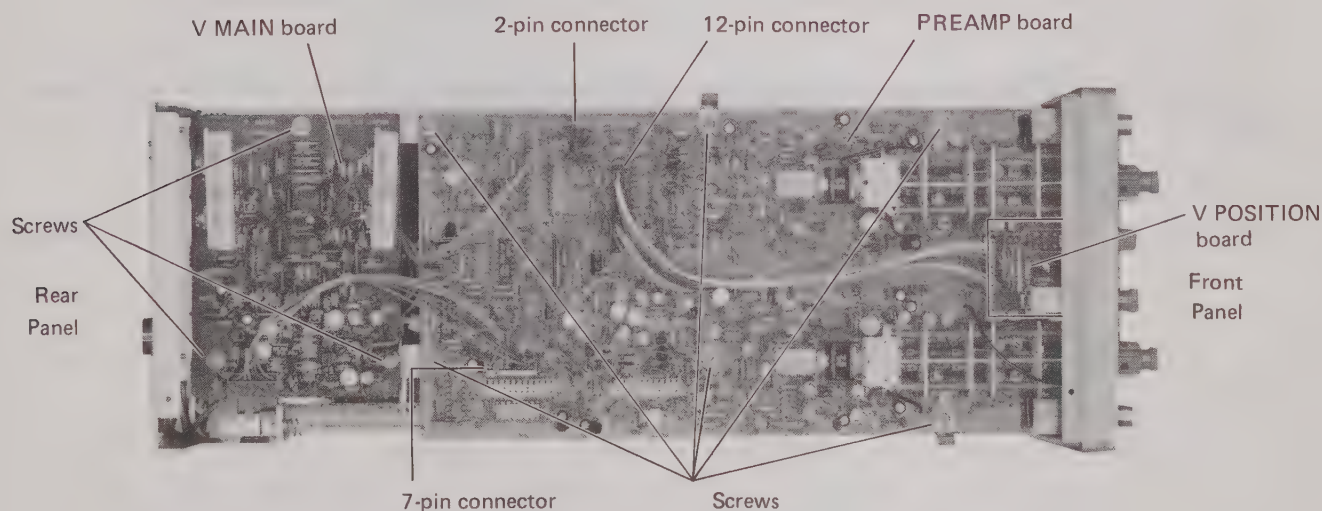
(b) V MAIN Board (V MAIN AMP [4])

1. Remove the connectors attached to this board.
2. Remove the three screws holding this board.

(c) V POSITION Board (CH1 CH2 PREAMP [1][2])

1. Remove the connectors attached to this board.
2. Remove CH1-CH2 and $\downarrow$ POSITION variable resistor.
3. Remove the hexagon nuts holding the $\downarrow$ POSITION variable resistor.

Figure 3-2-3-(1). Printed circuit board replacement I (Left)



Right Side

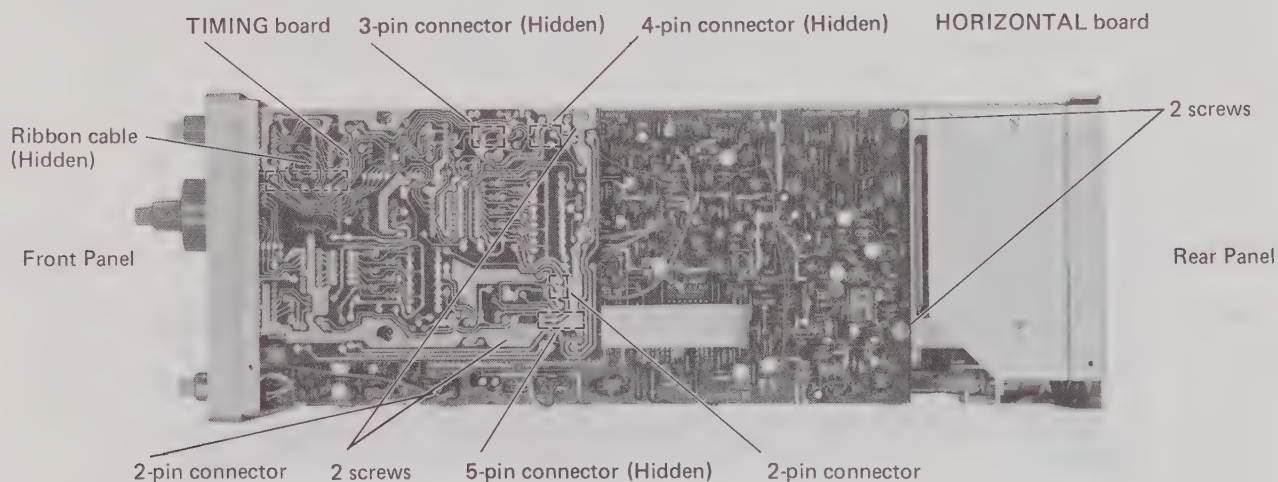
(d) TIMING Board (A TIMING **9**, B TIMING **10**)

1. Remove the A VARIABLE and A-B TIME/DIV knobs.
2. Remove the hexagon nut holding the TIME/DIV switch.
3. Remove the two screws holding this board.
4. Remove the connectors attached to this board.

(e) HORIZONTAL Board (TRIGGER GENERATOR [5], A SWEEP GENE [7], B SWEEP GENE [8], H AMP [11], CH3 PREAMP [5])

1. Remove the TIMING board.
2. Remove the HOLDOFF and TRACE SEPARATION knobs.
3. Remove the hexagon nuts holding the variable resistors.
4. Remove the connectors and cables attached to this board.
5. Remove the two screws holding this board and the hexagonal pillars.

Figure 3-2-3-(2). Printed circuit board replacement II (Right)



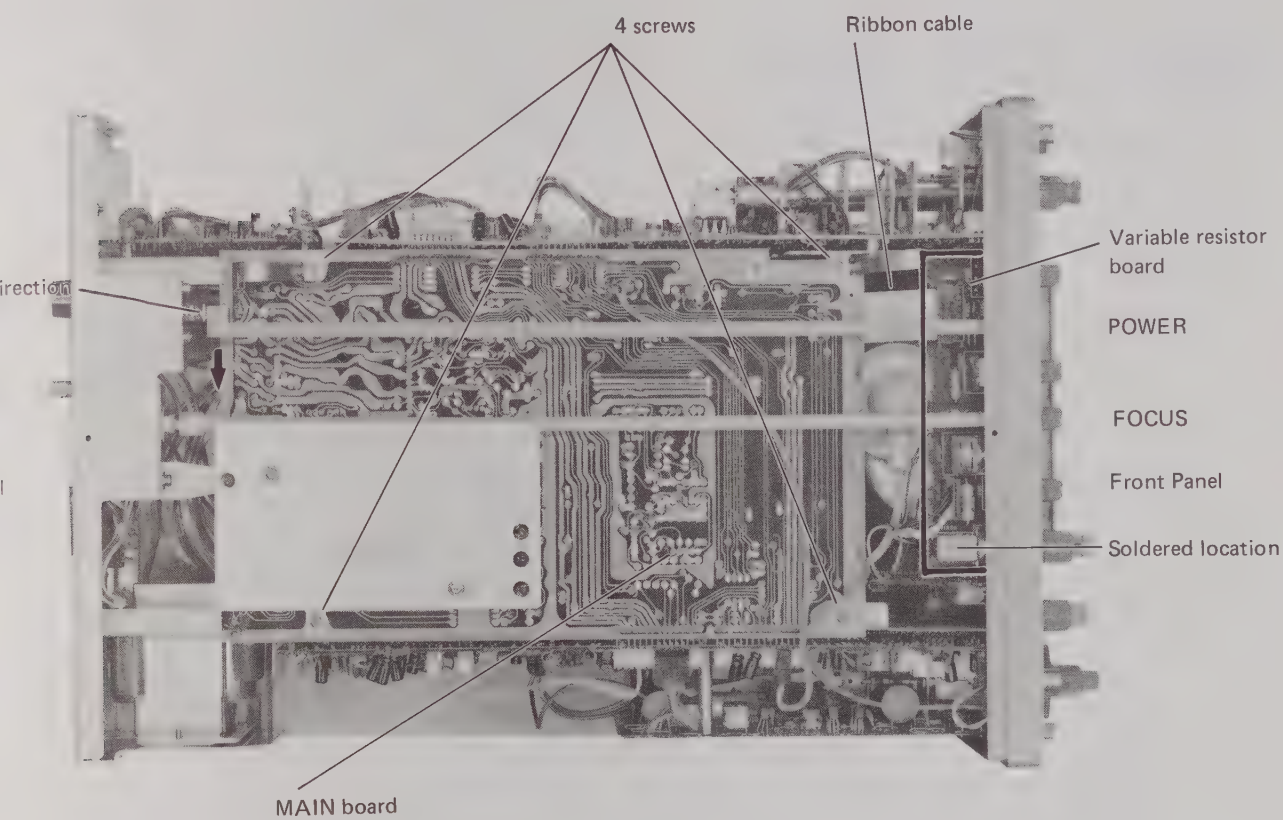
Bottom**(f) MAIN Board (Z AXIS & CRT CIRCUIT 12, POWER 13)**

1. Remove the PREAMP board, TIMING board, and HORIZONTAL board on the left and right sides.
2. Remove the three screws and then remove the high voltage cover.
3. Pull out the FOCUS knob. Use a tool to hold the FOCUS variable resistor at the junction (see Figure 3-2-3(3)) of the extension shaft and FOCUS variable resistor and pull out the extension shaft.
4. Open the end of the extension shaft at the junction of the POWER switch and extension shaft (see Figure 3-2-3(3)) and move in the direction of the arrow to remove the extension shaft. Note that if moved without opening the end, the ridge holding the switch will be scraped and the switch will become loose. Also open the end of the extension shaft when attaching it to the switch.
5. Remove the connectors attached to this board.
6. Remove the four screws holding this board.

(g) VOLUME Board

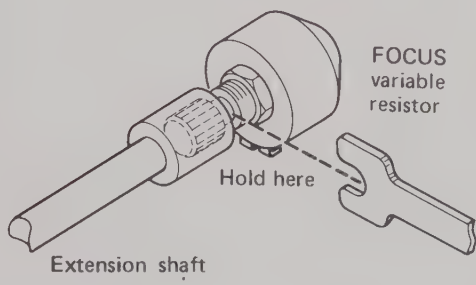
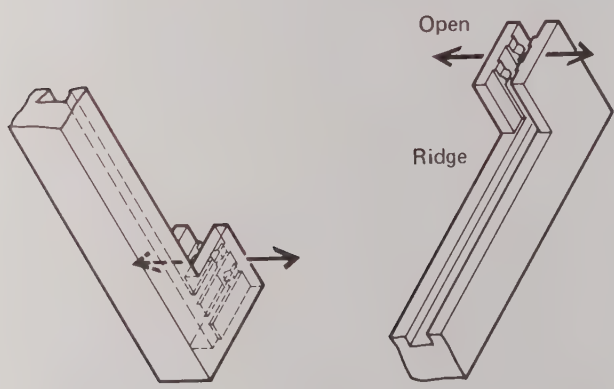
1. Remove the FOCUS knob from the extension shaft as described in (f).
2. Remove the POWER switch from the extension shaft as described in (f).
3. Remove the flat cable.
4. Remove the solder from the soldered location.
5. Remove the CH3 POSITION, INTEN, SCALE, ↔ POSITION, and FINE knobs.
6. Remove the hexagon nuts holding each variable resistor.

Figure 3-2-3-(3). Printed circuit board replacement III (Bottom)



Extension shaft for POWER switch

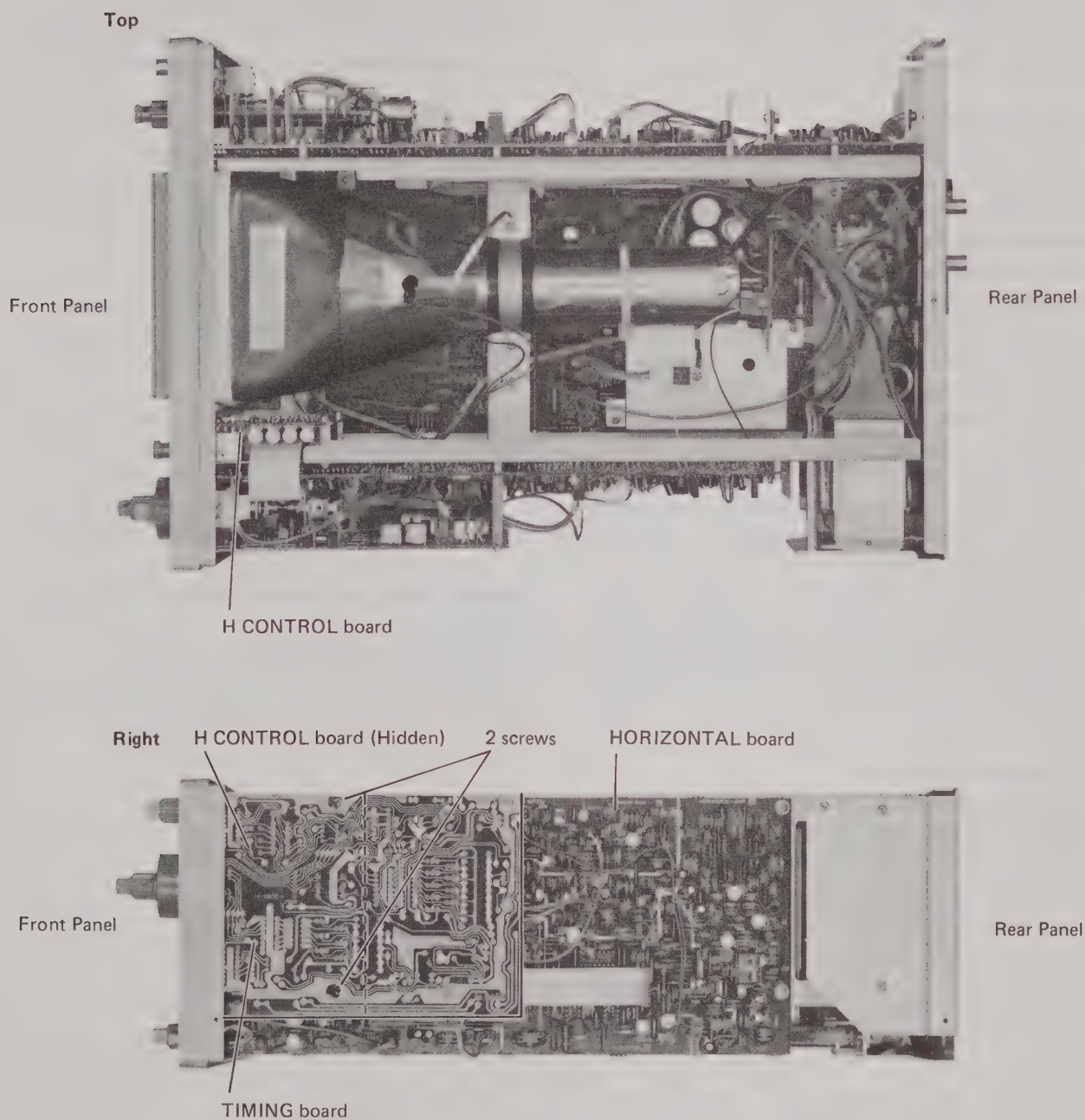
Junction between FOCUS variable resistor and extension shaft



Top**(h) H CONTROL Board (H CONTROL [6])**

1. Remove the ribbon cable attached to the HORIZONTAL board.
2. Remove the LEVEL and DELAY TIME knobs.
3. Remove the nuts holding each variable resistor.
4. Loosen the right side the two screws holding the board.
5. Slide the board back and then lift up.

Figure 3-2-3-(3). Printed circuit board replacement IV



3-2-4 Part Replacement

The replacement procedures for faulty parts detected by circuit inspection are described here. Be sure to disconnect the power cord from the electrical outer before replacing any faulty parts.

(a) Parts on Printed Circuit Board

In replacing diodes, transistors, IC's, resistors, or capacitors, on a printed circuit board, use your soldering iron carefully so that neither the copper foil of the printed circuit board will be peeled off nor any parts on the circuit board will be damaged.

Because the semiconductors, such as transistors and diodes, are not thermal-resistant, pinch the leads with tweezers and solder them quickly component so that the heat of the soldering iron will not be directly conveyed to the semiconductor. Diodes and transistors used for replacement must have good performance.

The resistors, capacitors, and other passive elements used in the instrument are carefully selected so any replacement parts to be used in their place must have good ones. (See the parts list in section 6.)

Electrode contact of transistor or diode and serious variation of their characteristics may incidentally make a resistor burn or a capacitor short-circuit. If such a trouble should occur, eliminate the cause of it before replacing the faulty part.

(b) Transistors Diodes or IC's

In replacing a transistor, diode, or IC, make sure of the electrodes. (see Table 3-4-1 and 3-4-2)

Particularly, transistors must be replaced with ones that have good performance.

(c) Switches

VOLTS/DIV rotary switches

1. Remove the PREAMP board. (See 3-2-3)
2. Melt the solder that fastens the printed circuit board by using a soldering iron, and remove the switches.

TIME/DIV rotary switch

1. Remove the TIMING board. (See 3-2-3)
2. Melt the solder that fastens the printed circuit board by using a soldering iron, and remove the switch.

Vertical MODE and AC-DC, GND push-button switches

1. Remove the PREAMP board. (See 3-2-3)
2. Melt the solder that fastens the printed circuit board by using a soldering iron, and remove the switches.

Trigger COUPLING, trigger SOURCE slide switch and CH3 AC-DC pushbutton switches

1. Remove the HORIZONTAL board. (See 3-2-3)
2. Melt the solder that fastens the printed circuit board by using a soldering iron, and remove the switches.

Horizontal MODE and HORIZ DISPLAY Push Button Switches

1. Remove the H CONTROL board. (See 3-3-3)
2. Melt the solder that fastens the printed circuit board by using a soldering iron, and remove the switches.

(d) CRT

Handle the CRT carefully in replacing it because it will be damaged easily by dropping or shock.

The CRT removal procedure is as follows:

1. Remove the rear panel and top cover.
2. Carefully back the socket on the CRT socket board and remove.
3. Remove the 2-pin connector (with blue and green lead wires) on the main board.
4. Remove the four ground wires connecting the CRT case and ground. Three of these are screwed on the ground side. Remove these screws. The other is soldered on the circuit board. Remove the solder.
5. Remove the two screws on the CRT supporting plate B to remove the board.
6. Carefully pull back the CRT and shield case to remove from the main unit except for the anode cap connection.
7. Discharge any remaining high voltage and then remove the anode cap.
8. Remove the black tape around the shield case.

9. Melt the solder that fastens the shield case with a soldering iron.

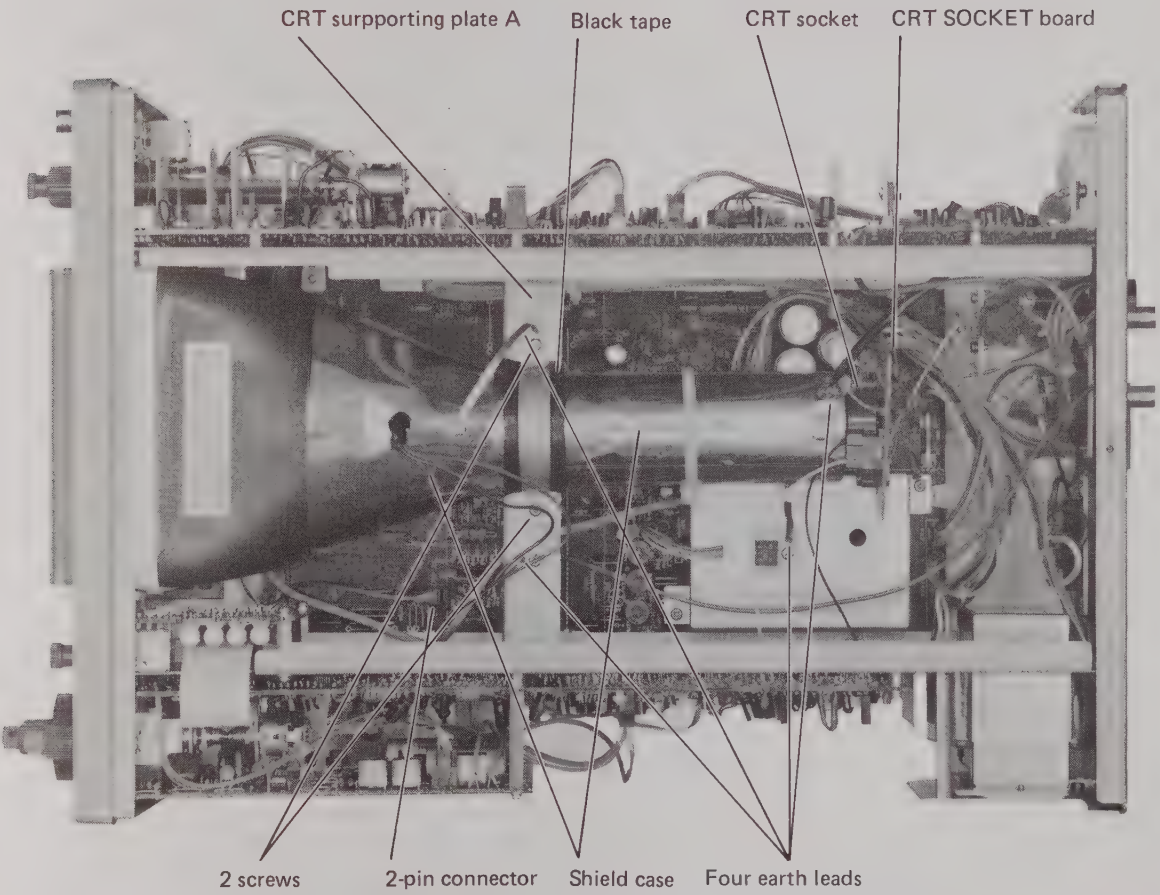
10. Remove the CRT from the shield case.

Reverse the above procedure for installing the CRT. If the CRT has been replaced, readjustments must be made by referring to section 4 Check and Adjustment.

NOTE

Use a torque driver to tighten the screws holding the CRT supporting plate B. Set the torque at 2.5 kg f cm and alternately tighten the two screws. Do not apply force greater than 2.5 kg f cm.

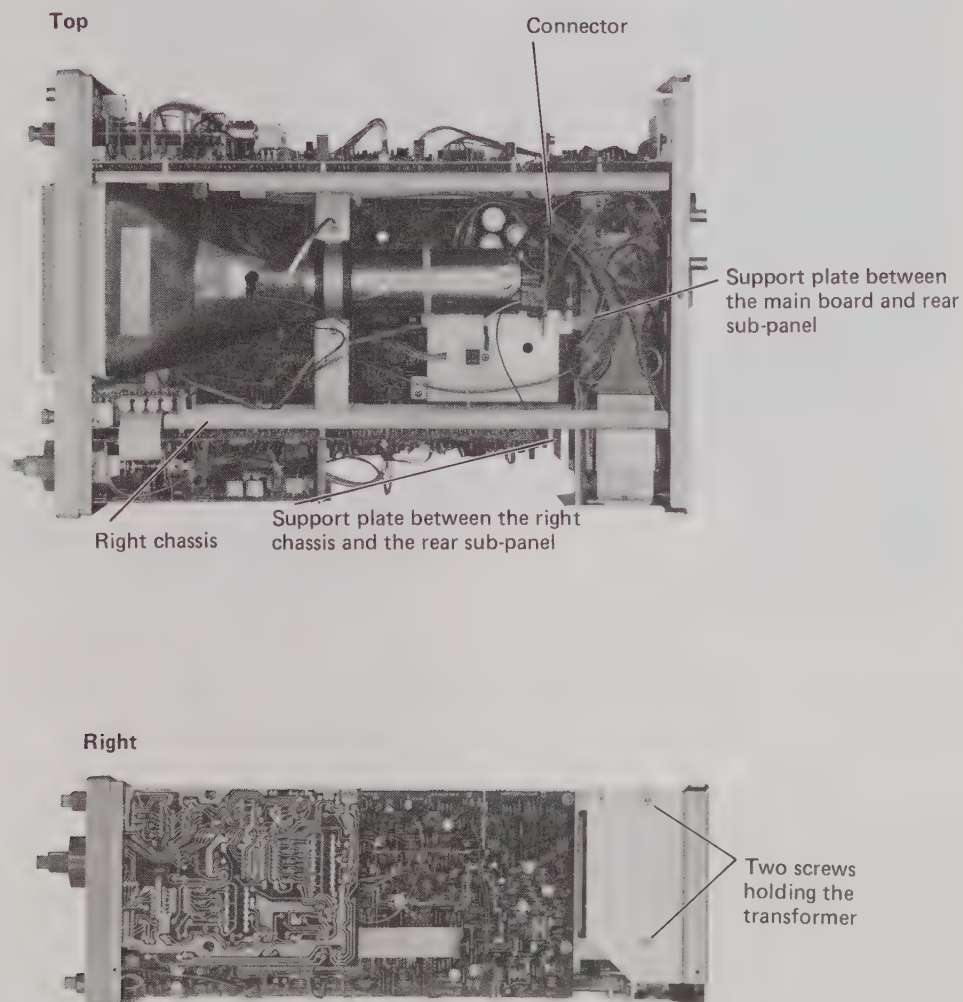
Figure 3-2-4-(1).

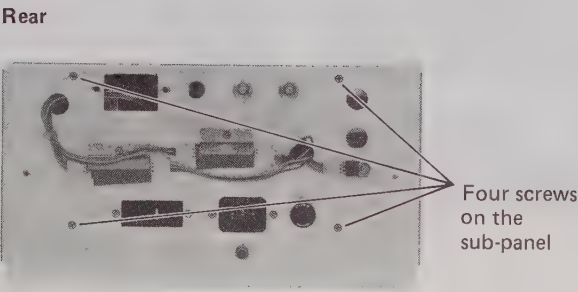
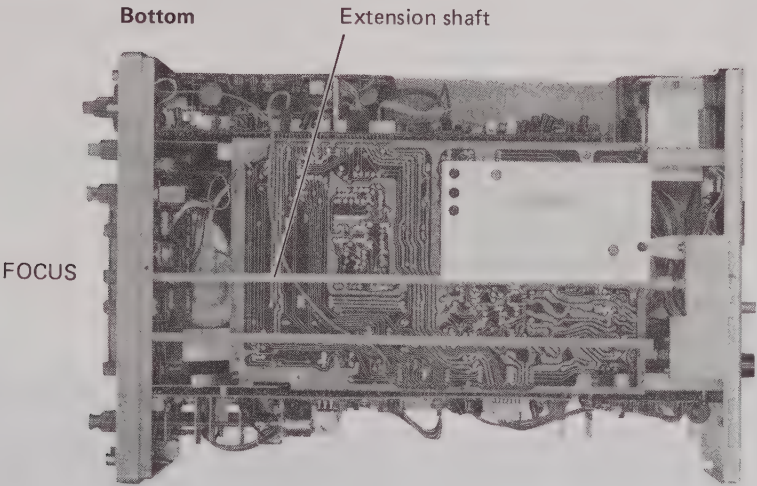


(e) Power Transformer

1. Remove the connectors attached to the transformer.
2. Remove the FOCUS knob and extension shaft (see 3-2-3).
3. Remove the support panel between the main board and rear sub-panel.
4. Remove the support panel between the right chassis and rear sub-panel.
5. Remove the two screws holding the transformer.
6. Remove the four screws on the sub-panel and remove the sub-panel.

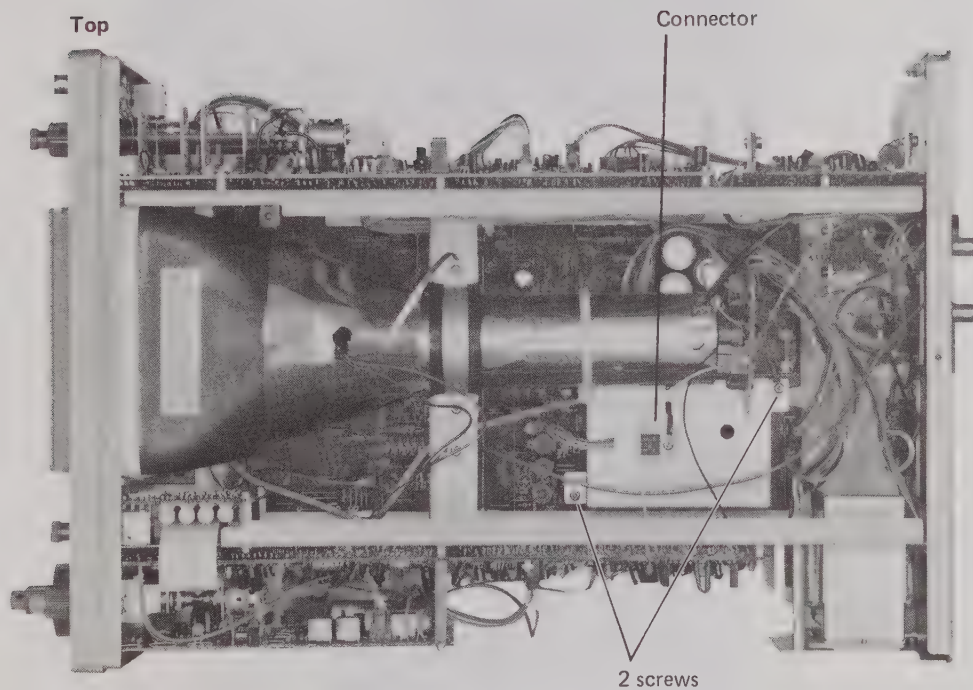
Figure 3-2-4-(2). Power transformer replacement





(f) High Voltage Transformer Replacement

1. Remove the connectors attached to the transistors on the high voltage shield case.
2. Remove the two screws and remove the high voltage shield case.
3. Remove the solders from the soldered locations on the main board.



3-3 TROUBLESHOOTING

3-3-1 Troubleshooting Reference

Schematic Diagrams

In this manual, schematic diagrams are grouped, in general, with the circuit blocks classified in Figure 2-1.

Circuit Layout

Layout of circuits on the printed circuit boards is shown in Figure 3-3-1-(1) to 3-3-1-(4). Use the photographs for inspection.

Parts Layout

Refer to part No. printed on the printed circuit board to identify parts mounted on the board.

Electrodes Marking of Diodes Transistors and FET

Table 3-3-1-(1), 3-3-1-(2) and 3-3-1-(3) show the electrodes marking of diodes and transistors, by type.

Color Code of Resistors

Most of the resistors in the circuit are color coded by resistance value. See Figure 3-3-1-(4) for the color code.

3-3-2 Instruments Required for Troubleshooting

The following instruments are required at least for troubleshooting of this oscilloscope.

(1) Multimeter

Input resistance	: 10 M Ω
Voltage range	: 0 to 300 V and special position for 2 kV
Ohm-range	: 0 to 10 M Ω

(2) Transistor curve tracer

(3) Oscilloscope

Frequency response:	DC to 100 MHz
Deflection factor	: 5 mV/div

3-3-3 Troubleshooting Steps

The first thing in troubleshooting is to examine if a irregular event like "a circuit trouble" is really due to a troubles within the circuit, or caused by external events. For example, certain irregular operations will occur, in a normal oscilloscope, if the line voltage is out of the rated voltage range, or a signal input connector is affected by induction of an external signal.

Then, repeatability of the trouble must be checked. For example, when sweep is normal but an irregular signal is displayed with a signal supplied to the signal input connector, the other signal must be supplied to the input to check if the same irregular display occurs (if it occurs, the oscilloscope is responsible for the trouble).

When troubles persist against these preparatory checks, the following actual steps must be performed.

1. Remove the covers from the instrument and ascertain the circuit which has the trouble by the troubleshooting flow chart shown in Figure 3-3-3.
2. Visually inspect parts, wirings, coupling of connectors, soldering and copper foils of the circuit board, which are suspect.
3. Check the action of the ascertained circuit by using a multimeter or test oscilloscope and refering the voltages and waveforms shown in the schematic diagram.
4. Finally, check suspect parts for the trouble by using a multimeter or curve tracer and replace the defective parts.

Figure 3-3-1-(1). Circuit layout (Top)

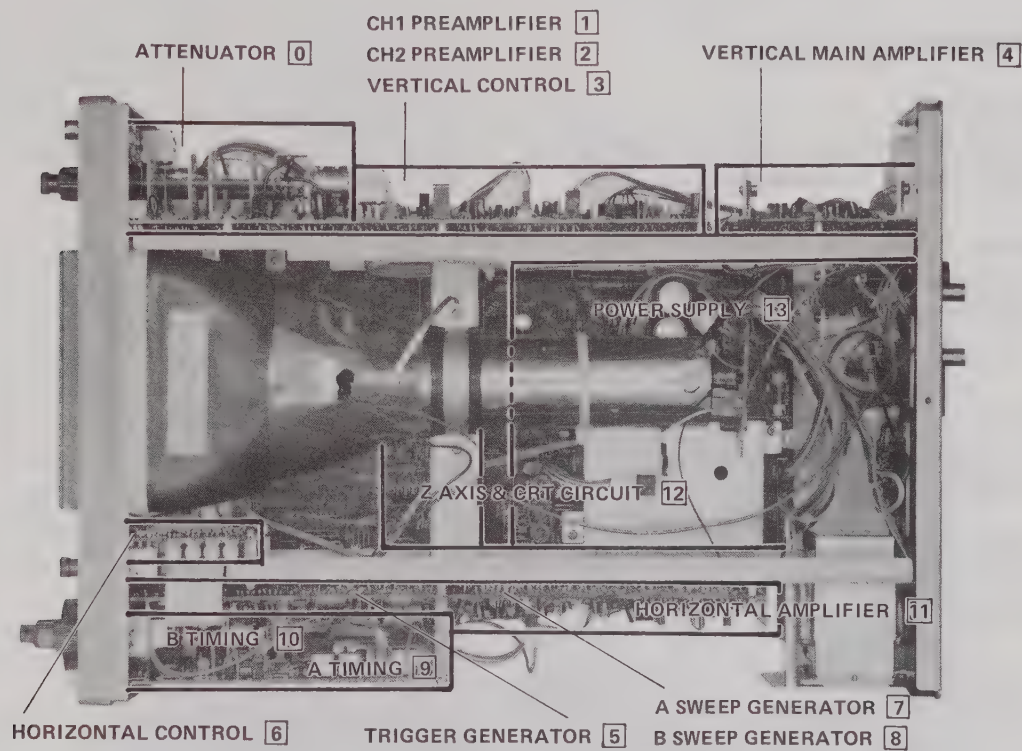


Figure 3-3-1-(2). Circuit layout (Left side)

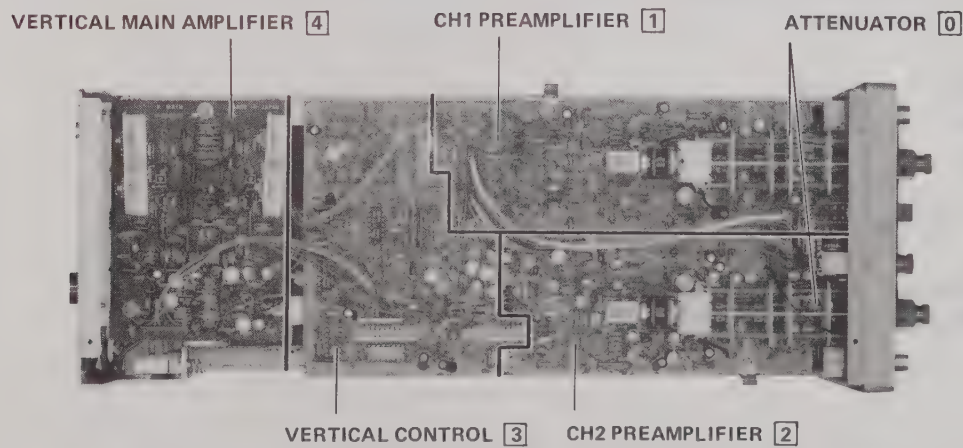


Figure 3-3-1-(3). Circuit layout (Right side)

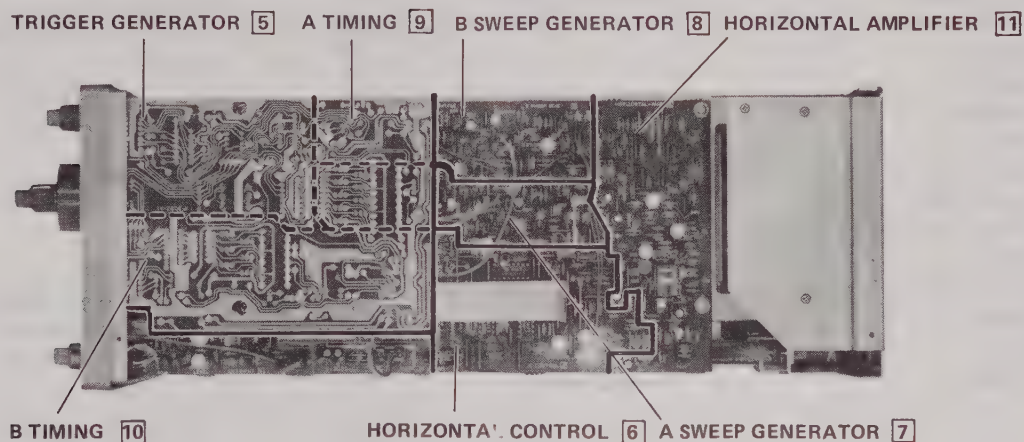


Figure 3-3-1-(4). Circuit layout (Bottom)

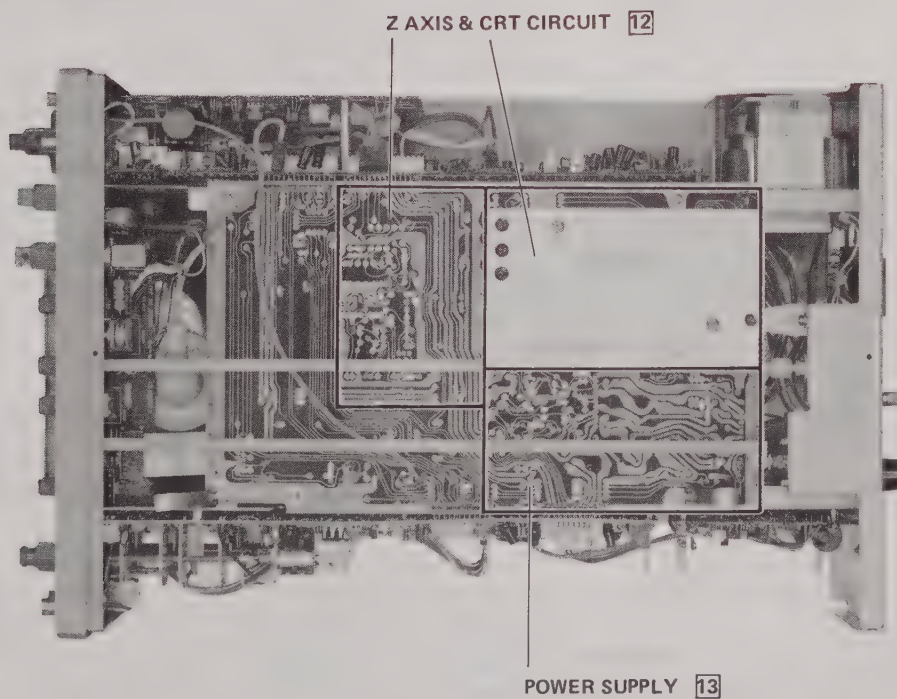


Table 3-3-1-(1) Marking of Diode Electrode

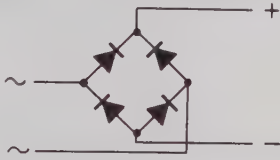
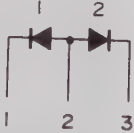
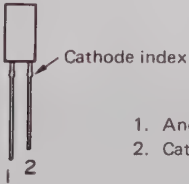
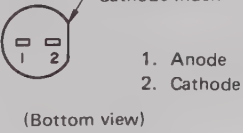
Type of diode	Electrode marking	Polarity or connection
1S953 1S955 1S1544A 1K34A 1SS97 ESJA35-12		
V06E		
1SV69		
RD type		
1D4B1 1B4B1		
DAP201	 1 2 3 1. Cathode 1 2. Anode 1 and 2 3. Cathode 2	
DA203	 1 2 3 1. Cathode 1 2. Anode 1 and cathode 2 3. Anode 2	
TLR206 TLG206	 1 2 Cathode index 1. Anode 2. Cathode	
TLG144	 1 2 Cathode index 1. Anode 2. Cathode (Bottom view)	

Table 3-3-1-(2) Marking of transistor electrode

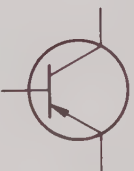
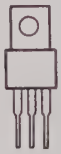
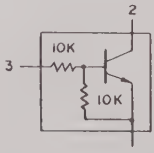
Type of diode	Electrode marking	Connection
2SC1815GR 2SC1907	 1 2 3 (Bottom view) 1. Emitter 2. Collector 3. Base	
2SC2037 2SC2901	 1 2 3 (Bottom view) 1. Emitter 2. Base 3. Collector	
2SA899 2SB648AC	 1 2 3 1. Emitter 2. Collector 3. Base	
2SB861C 2SB941P/Q	 1 2 3 1. Base 2. Collector 3. Emitter	
2SA1015Y 2SA992F	 1 2 3 (Bottom view) 1. Emitter 2. Collector 3. Base	
2SA1206 2N3905	 1 2 3 (Bottom view) 1. Emitter 2. Base 3. Collector	
2SC1904 2SD668AC	 1 2 3 1. Emitter 2. Collector 3. Base	
2SC2502 2SD1137 2SD1266P/Q	 1 2 3 1. Base 2. Collector 3. Emitter	
DTC114A	 1 2 3 1. Emitter 2. Collector 3. Base	

Table 3-3-1-(3) Marking of FET electrode

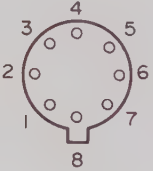
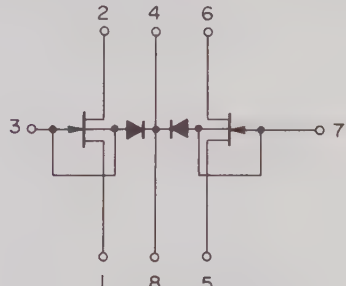
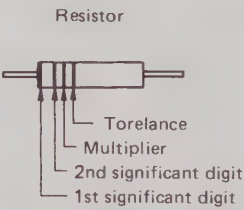
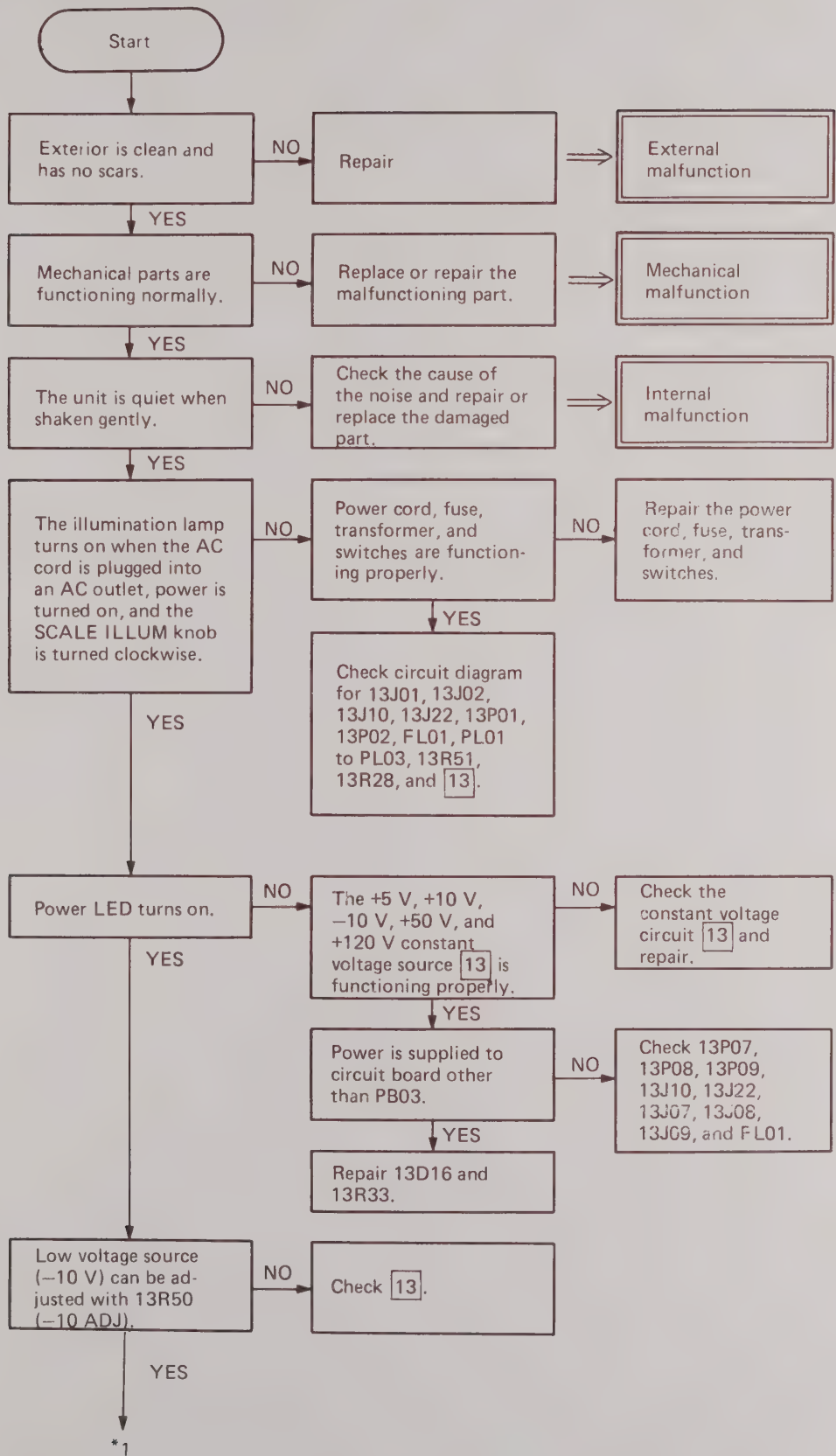
Type of FET	Electrode marking	Connection
2SK30AY	 1. Source 2. Gate 3. Drain	
μPA61AL	 1. Source 1 2. Drain 1 3. Gate 1 4. Sub 5. Source 2 6. Drain 2 7. Gate 2 8. Sub	

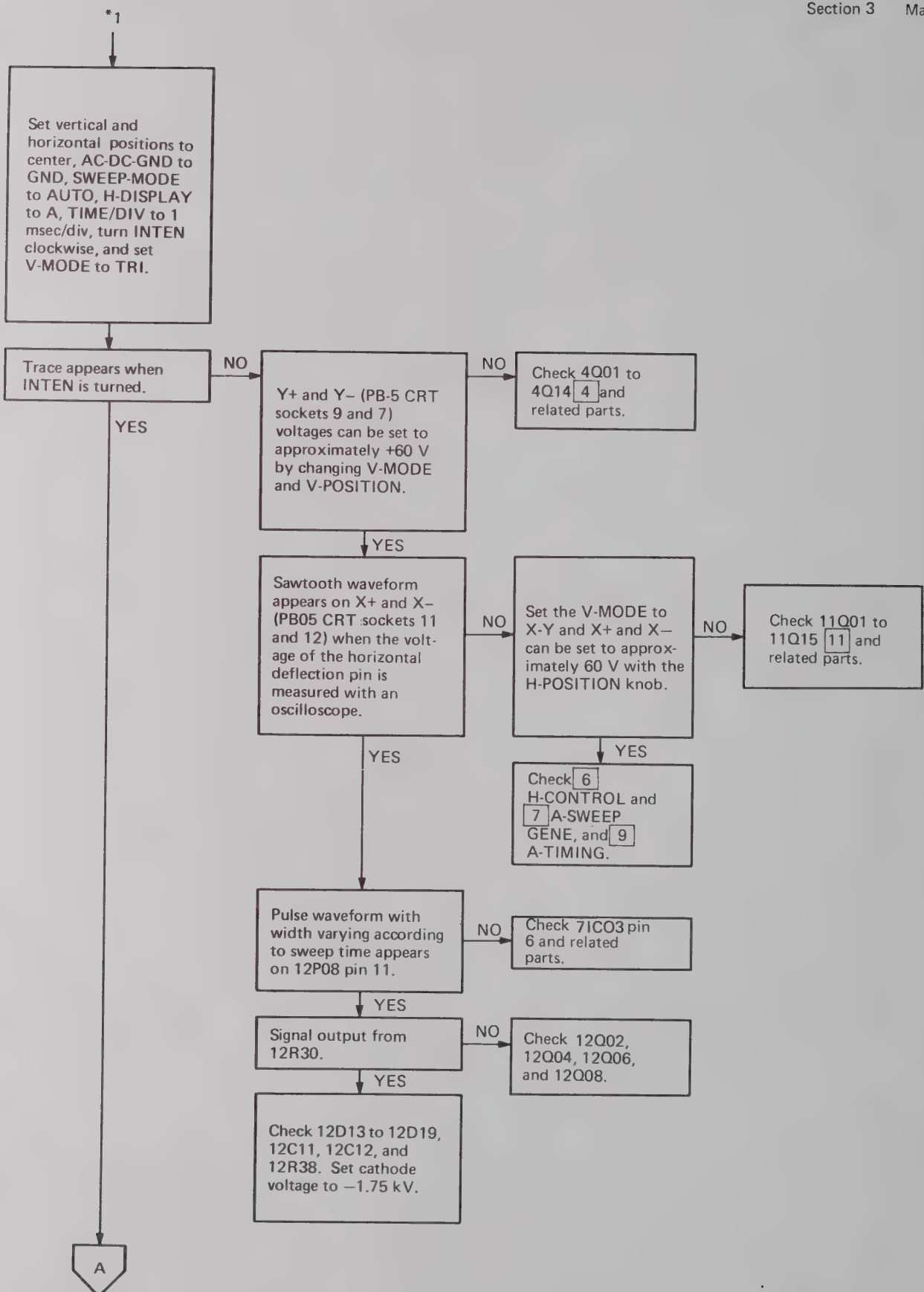
Table 3-3-1-(4) Color coading of resistor

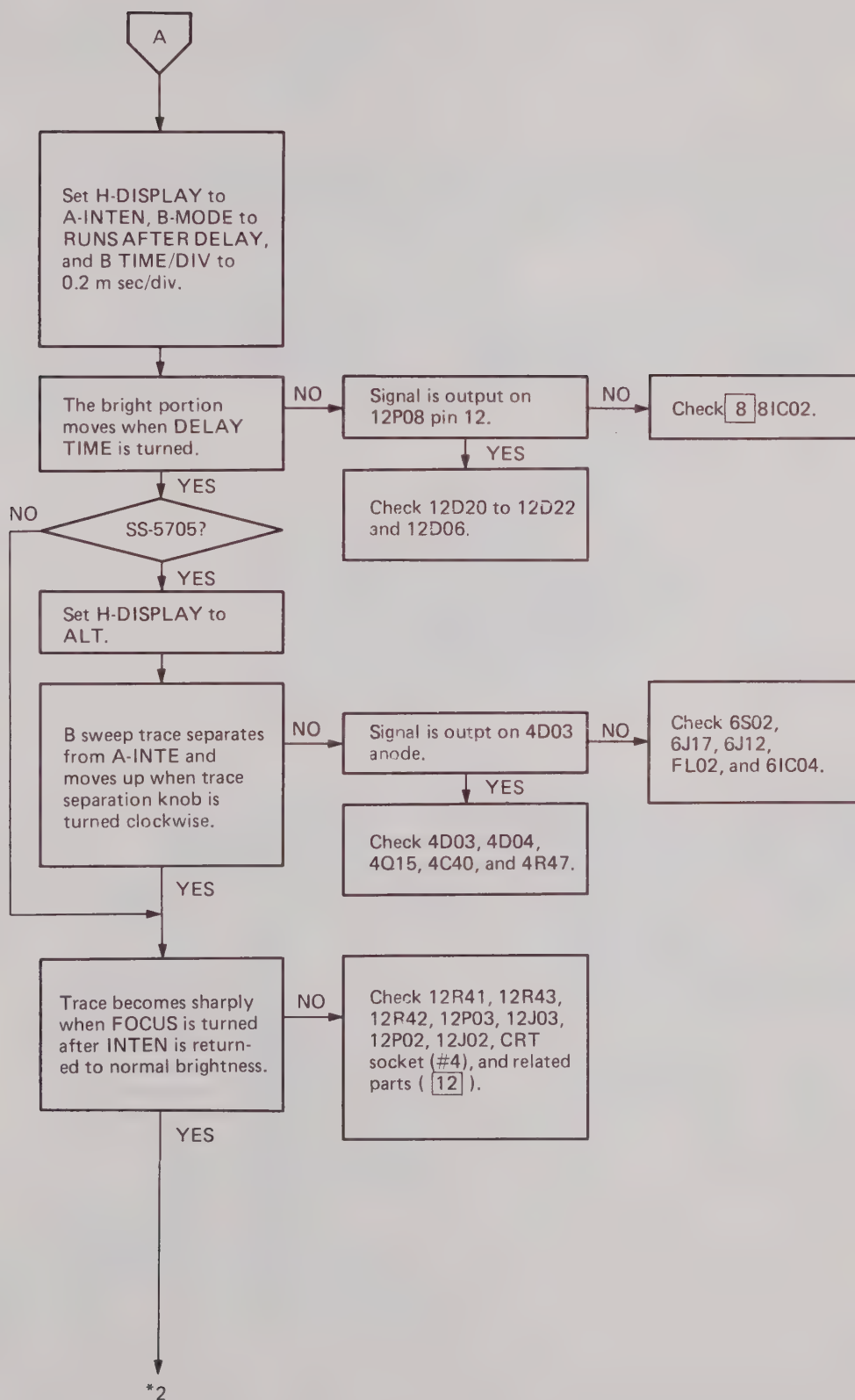


Color	Resistance value		Tolerance for resistor
	1st or 2nd significant digit	Multiplier	
BLK	0	1	-
BRN	1	10	±1
RED	2	10 ²	±2
ORG	3	10 ³	-
YEL	4	10 ⁴	-
GRN	5	10 ⁵	-
BLU	6	10 ⁶	-
VLT	7	10 ⁷	-
GRY	8	10 ⁸	-
WHT	9	10 ⁹	-
GOLD	-	10 ⁻¹	±5
SIL VER	-	10 ⁻²	±10
No color	-	-	±20

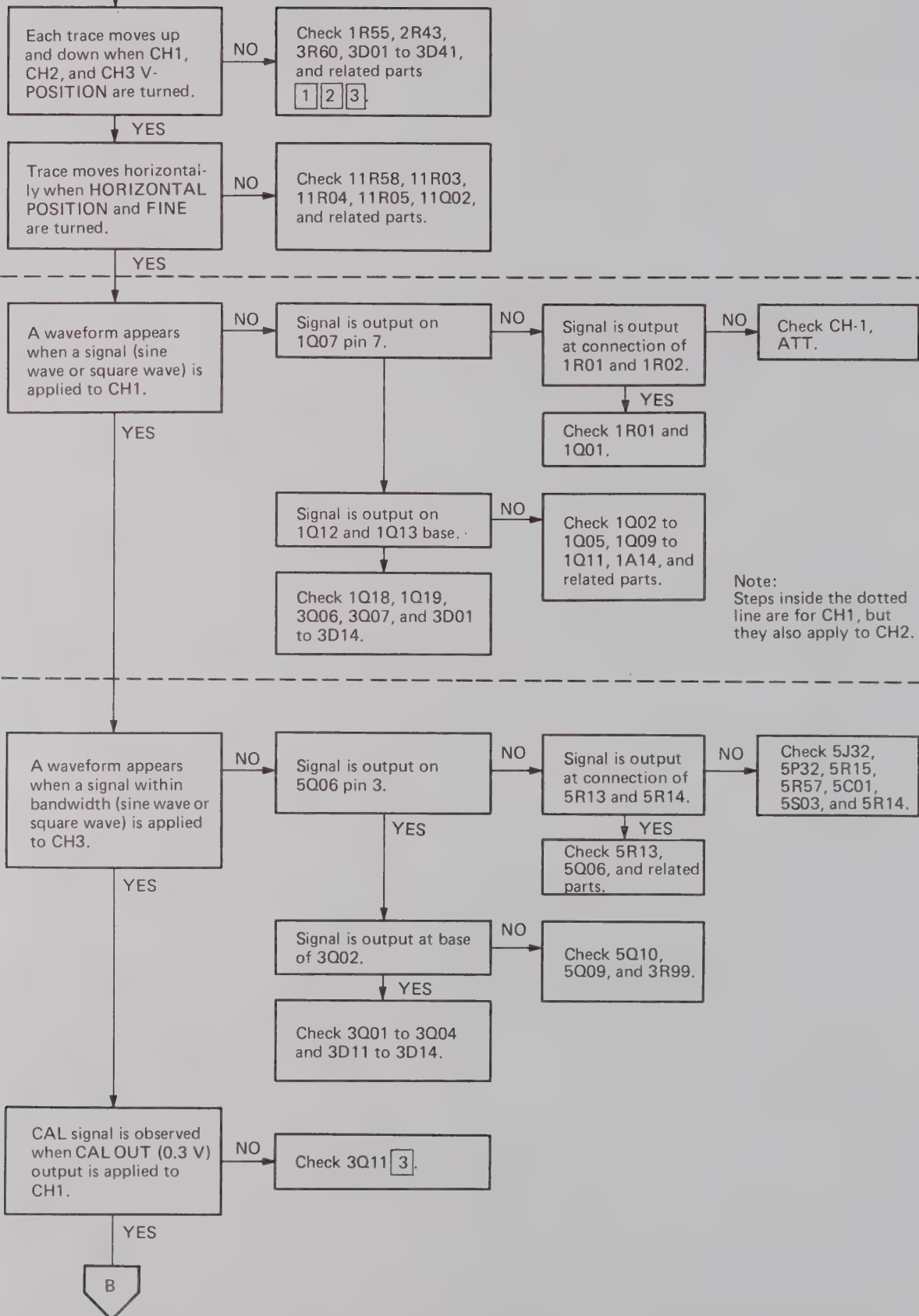
3-3-4 Troubleshooting Flow Chart

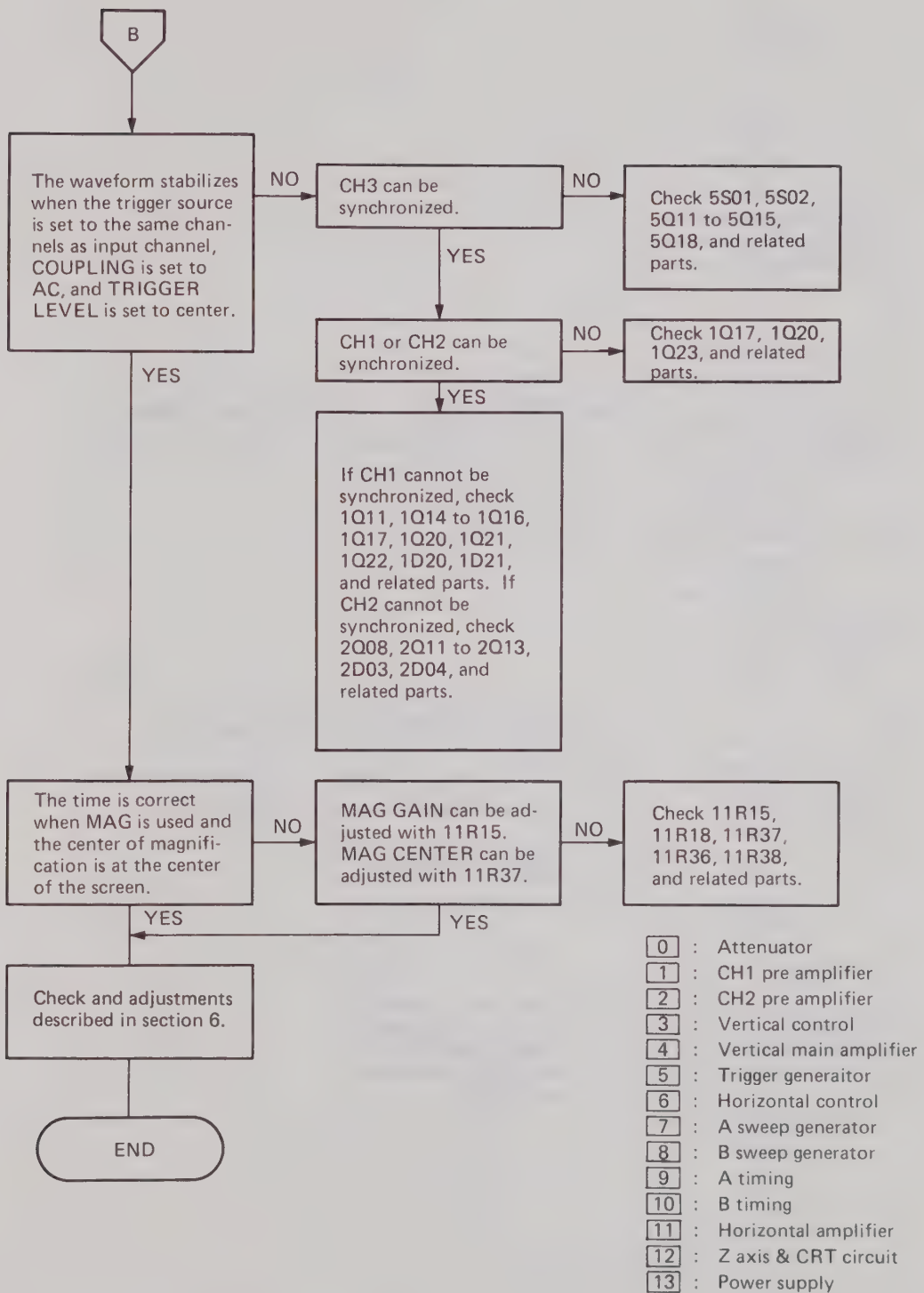






*2





Check and Adjustment

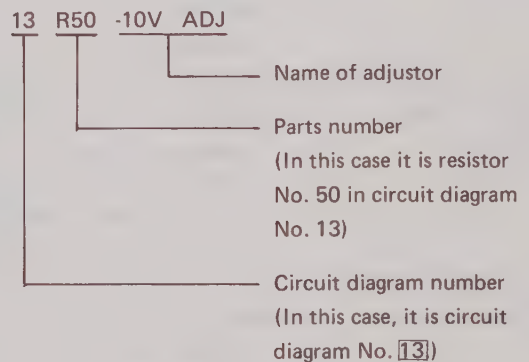
4-1 GENERAL

Correct measurement requires the normal operation of each circuit in SS-5706 and satisfactory maintenance of their performance.

With the regular performance check and adjustment, SS-5706 can develop its functions in a reliable manner for a long period of service. This section describes the appropriate method of check and adjustment.

3. The low-voltage power is supplied to all circuits. If its voltage or ripple goes outside the specified values, then other performance will be affected. In check and adjustment, therefore, check the low-voltage power supply first.
4. The CRT has a high-voltage. For its check and adjustment, be careful not to catch an electric shock.
5. In the pictures in the inspection and calibration sections, the letters and numbers on the adjusting instruments have the following meanings:

< Example >



4-2 PERIOD OF CHECK AND ADJUSTMENT

The regular and periodical check and adjustment of performance is necessary for correct measurement. The proper check intervals for SS-5706 are six months.

4-3 PRECAUTIONS FOR CHECK AND ADJUSTMENT

For the performance check and adjustment, pay attention to the following:

1. In each check and adjustment items, the description for the control knob manipulation presupposes the setting completed for from 4-6 Preparation. Whether the check and adjustment are carried out for all items or for limited items, make sure to start the operation from the point where the setting has been made according to the preparation for check and adjustment.
2. Some signal generator outputs at a 50 Ω termination; so using a coaxial cable with characteristic impedance of 50 Ω (e.g. BB-120 by Iwatsu), terminate the cable end at the scope side with a 50 Ω terminator (e.g. BB-50M1 by Iwatsu).

4-4 EQUIPMENT REQUIRED

The check and adjustment requires the equipment and accessories as described in table 4-4-1. The equipment must have the performance equal to or greater than those described in the table. The signal input connector of SS-5706 is BNC. If the terminator or signal output terminal is other than BNC, prepare a converter connector.

Table 4-4-1 List of equipment required

Equipment	Minimum Specifications	Purpose	Recommended Model	
			Iwatsu	Equivalent
1. Scope calibrator • Calibration voltage generator • Time-mark generator • Repetition interval • Sine wave generator • Repetition ratio generator • Fast rise signal generator	: 0.12mV to 60V $\pm 0.5\%$ or less : 20nsec to 2 sec $\pm 0.05\%$ or less : 1 kHz $\pm 20\%$ or less Frequency range : 50Hz to 200kHz Rise time : 5nsec or less Repetition : 50Hz to 200kHz Rise time : 300 ps or less	Vertical, triggering and horizontal checks and adjustments	SC-340	
2. Standard signal generator	Frequency : 50kHz to 60MHz Output level : 60mV or more	Pattern distortion, bandwidth inspection and calibration of phase difference during X-Y operation		
3. Digital volt-meter	Range : DC to 200VDC $\pm 0.2\% + 1$ dgt	Low-voltage power supply checks and adjustments	SC-7401	
4. High-voltage probe	Range : DC to 15kVDC $\pm 3\% + 1$ dgt	Inspection and calibration of CRT voltage	High-voltage probe (SC-7401 option)	
5. Test Synchroscope	Bandwidth : DC to 10MHz Minimum deflection factor: 1mV/div	Low-voltage power supply checks and adjustments	SS-5702	
6. Attenuation rate of oscilloscope probe	1 : 1	Low-voltage power supply checks and adjustments	SS-0001 ~ 3	

Table 4-4-1 List of equipment required (cont.)

Equipment	Minimum Specifications	Purpose	Recommended Model	
			Iwatsu	Equivalent
7. Frequency counter	Range: 10Hz to 1.5MHz Resolution: 1Hz	Inspection and calibration of CRT voltage	SC-7101	
8. Voltage regulator		AC line voltage range check		
9. Termination (2 required)	Impedance: 50 Ω	Signal termination	BB-50MI	
10. 6 dB divider		Signal interconnection	B-50D3	
11. BNC coaxial cable (2 required)	Impedance: 50 Ω Length: 120mm	Signal input	BB-120C	
12. Supplied probe Attenuation ratio	10 : 1	Signal input	SS-0060	
13. Screwdriver (Attached to probe)		Adjust variable resistors and capacitors		

4-5 CHECK AND ADJUSTMENT ITEMS

The check and adjustment items are shown in Table 4-5-1.

The right column indicates items that may be affected by adjustment.

Together with one item, also check and adjust other items that may be affected by that item.

In check and adjustment of all items, do them in the following sequence:

Table 4-5-1 Items and interactions

Order	Checks and adjustments items		Page	Checks and adjustments affected
	4-7 Power supply and CRT			
1	4-7-1	Secondary DC power supply voltage (output voltage)	4-6	All items
2	4-7-2	Secondary DC power supply voltage (ripple voltage)	4-8	All items
3	4-7-3	CRT cathode voltage	4-9	4-7-4, 4-7-5, 4-9-1, 4-9-2, 4-9-11, 4-11-1, 4-11-3, 4-12-1
4	4-7-4	Intensity	4-10	4-7-7
5	4-7-5	Focus	4-11	
	4-8 Calibrator output			
6	4-8-1	Output voltage	4-12	
7	4-8-2	Repetition rate	4-13	
	4-9 Vertical deflection system			
8	4-9-1	CH1—CH2 Deflection factor	4-14	
9	4-9-2	CH3 Deflection factor	4-16	
10	4-9-3	x 5 MAG DC balance	4-17	4-9-4, 4-10-1, 4-12-1
11	4-9-4	VARIABLE balance	4-18	4-9-5, 4-10-1, 4-12-1
12	4-9-5	CH2 polarity switching balance	4-19	
13	4-9-6	CH1-CH2 attenuator phase and probe phase	4-20	
14	4-9-7	CH3 Probe phase	4-22	
15	4-9-8	Square wave response I (Sag)	4-23	4-12-2
16	4-9-9	Square wave response II (Overshoot and other waveform distortion)	4-24	4-9-11, 4-9-12, 4-10-1, 4-12-2
17	4-9-10	Bandwidth	4-26	4-12-1
18	4-9-11	Linearity	4-27	

Table 4-5-1 Items and interactions (cont.)

Order	Checks and adjustments items	Page	Checks and adjustments affected
	4-10 Trigger system		
19	4-10-1 Triggering (CH1 • CH2 and CH3)	4-28	
20	4-10-2 B-triggering	4-30	
	4-11 Horizontal deflection factor		
21	4-11-1 Sweep rate	4-31	4-11-3, 4-12-1
22	4-11-2 Magnification center	4-34	4-12-1
23	4-11-3 Magnified sweep rate	4-35	
24	4-11-4 A sweep trace length	4-36	
25	4-11-5 Start and stop of delay	4-37	
26	4-11-6 Jitter	4-38	
	4-12 X-Y operation		
27	4-12-1 Deflection factor and intensity level	4-39	
28	4-12-2 Phase difference	4-40	

Precaution

Open the page to the left and refer to the contents when making check and adjustment of each item.

Table 4-6-1 Switch and Control Knob Setting Before Check and Adjustment

Switchs and controls	Setting
POWER	OFF
INTEN (PUSH BEAM FIND	Slightly right of the midrange
FOCUS	Midrange
SCALE	Full clockwise turn
VERTICAL MODE	CH1
⇅ POSITION (CH1 • 2)	Midrange (Push)
VOLTS/DIV (CH1 • 2)	5 mV
VARIABLE (CH1 • 2) (PULL x 5 MAG)*1	CAL
AC-DC (CH1)	DC
↔ POSITION	Midrange
FINE (PULL x 5 MAG)	Midrange (Push)
COUPLING	AC
SOURCE	CH1
HORIZONTAL MODE	AUTO
HORIZ DISPLAY	A
A TIME/DIV	1 ms
B TIME/DIV	1 ms
A VARIABLE	CAL
LEVEL	Midrange (Push)
SLOPE (PULL-)	
DELAY TIME	Full counterclockwise turn
HOLD OFF	Full counterclockwise turn
⇅ CH3 POSITION	Midrange
AC-DC (CH3)	DC

4-6 PREPARATION

Before making check and adjustment, prepare the following:

1. Set the ambient temperature at 23°C ± 5°C.
2. Before turning the power on, set the switches and control knobs as shown in the table at the left.

*1 : Only CH1 for SS-5706.

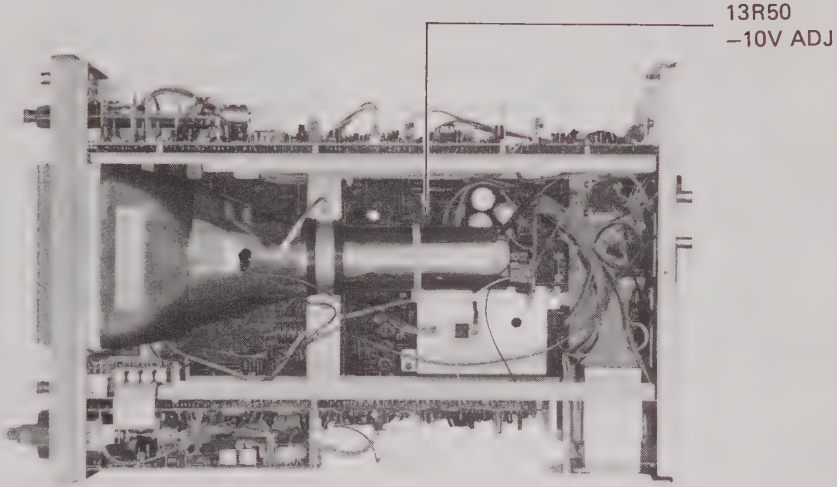
3. Set the voltage switch on the rear panel to meet the line voltage. Connect the power cord to the plug socket of the line. If the line voltage is outside the operating range of SS-5706, set the voltage within the range using a voltage regulator.
4. Turn POWER switch on to supply power, adjust INTEN to provide the proper intensity and trace, and keep the condition for about 30 minutes to warm up the machine.

4-7 POWER SUPPLY AND CRT CHECK AND ADJUSTMENT

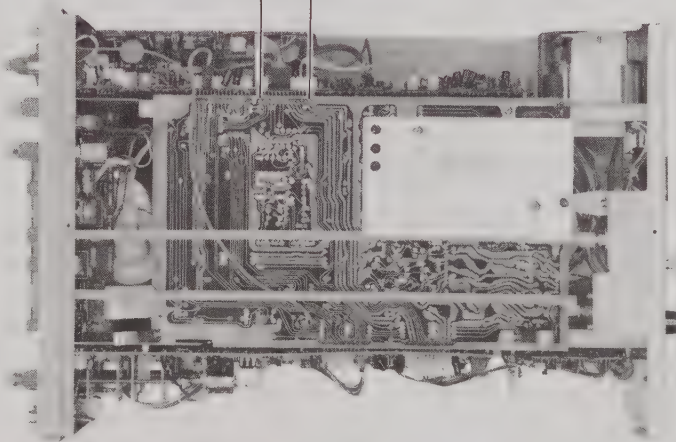
4-7-1 Secondary DC Power Supply Voltage (Output Voltage)

Item	Description																				
Rating	<table><tr><th>DC power voltage</th><th>Output voltage range</th><th>Measurement location</th></tr><tr><td>− 10 V</td><td>Within ±0.05V</td><td>13 P09 pin No. 10</td></tr><tr><td>+ 10 V</td><td>Within ±0.1 V</td><td>13 P09 pin No. 9</td></tr><tr><td>+ 60 V</td><td>Within ±1.2 V</td><td>13 P09 pin No. 13</td></tr><tr><td>+120 V</td><td>Within ±4.8 V</td><td>13 P08 pin No. 14</td></tr><tr><td>+ 5 V</td><td>Within ±0.25V</td><td>13 P09 pin No. 8</td></tr></table>			DC power voltage	Output voltage range	Measurement location	− 10 V	Within ±0.05V	13 P09 pin No. 10	+ 10 V	Within ±0.1 V	13 P09 pin No. 9	+ 60 V	Within ±1.2 V	13 P09 pin No. 13	+120 V	Within ±4.8 V	13 P08 pin No. 14	+ 5 V	Within ±0.25V	13 P09 pin No. 8
DC power voltage	Output voltage range	Measurement location																			
− 10 V	Within ±0.05V	13 P09 pin No. 10																			
+ 10 V	Within ±0.1 V	13 P09 pin No. 9																			
+ 60 V	Within ±1.2 V	13 P09 pin No. 13																			
+120 V	Within ±4.8 V	13 P08 pin No. 14																			
+ 5 V	Within ±0.25V	13 P09 pin No. 8																			
Test point and adjustment location	<table><tr><th rowspan="2">Measurement location</th><th colspan="2">Adjust ment location</th></tr><tr><th>Circuit symbol</th><th>Name</th></tr><tr><td>See figure at right</td><td>13R50</td><td>−10 V ADJ</td></tr></table>			Measurement location	Adjust ment location		Circuit symbol	Name	See figure at right	13R50	−10 V ADJ										
Measurement location	Adjust ment location																				
	Circuit symbol	Name																			
See figure at right	13R50	−10 V ADJ																			
Check and adjustment	1. Measure the voltage across the measurement position and the ground using digital multimeter and check that the values is within the rated values. 2. If the voltage is outside the rated value, adjust “−10V” with 13R50 −10V ADJ. Check voltages at other locations again. Note: The design is such that by adjusting −10V, other voltages can be set within the specification range.																				

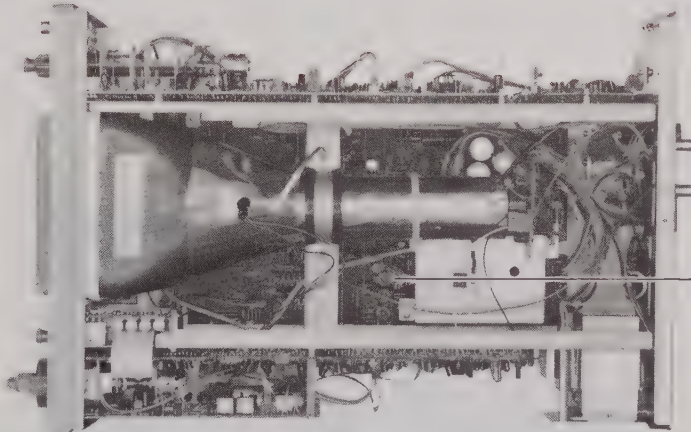
4-7-1 Secondary DC Power Supply Voltage (Output Voltage) (cont.)

Item	Description
	 13R50 -10V ADJ

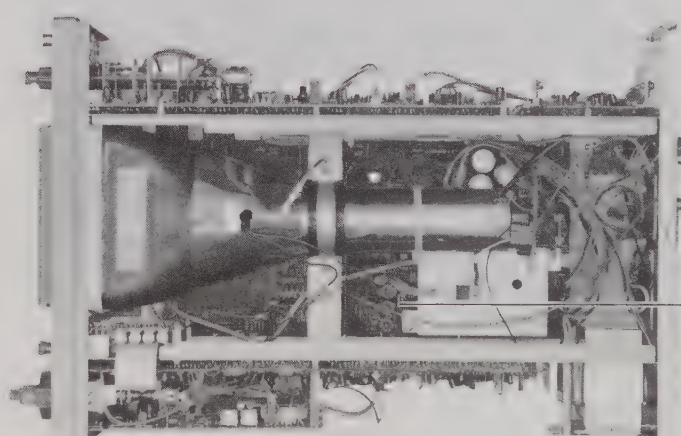
4-7-2 Secondary DC Power Supply Voltage II (Ripple voltage)

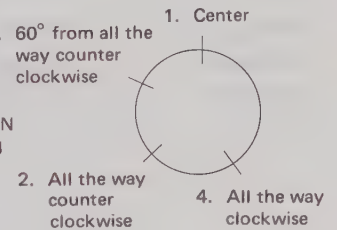
Item	Description																	
Rating	<table><tr><th>DC power voltage</th><th>Ripple voltage</th><th>Measurement location</th></tr><tr><td>− 10 V</td><td rowspan="2">0.5 mVp-p or less</td><td>13 P09 pin No. 10</td></tr><tr><td>+ 10 V</td><td>13 P09 pin No. 9</td></tr><tr><td>+ 50 V</td><td>1 mVp-p or less</td><td>13 P09 pin No. 13</td></tr><tr><td>+ 120 V</td><td>2 mVp-p or less</td><td>13 P09 pin No. 14</td></tr><tr><td>+ 5 V</td><td>3 mVp-p or less</td><td>13 P09 pin No. 8</td></tr></table>	DC power voltage	Ripple voltage	Measurement location	− 10 V	0.5 mVp-p or less	13 P09 pin No. 10	+ 10 V	13 P09 pin No. 9	+ 50 V	1 mVp-p or less	13 P09 pin No. 13	+ 120 V	2 mVp-p or less	13 P09 pin No. 14	+ 5 V	3 mVp-p or less	13 P09 pin No. 8
DC power voltage	Ripple voltage	Measurement location																
− 10 V	0.5 mVp-p or less	13 P09 pin No. 10																
+ 10 V		13 P09 pin No. 9																
+ 50 V	1 mVp-p or less	13 P09 pin No. 13																
+ 120 V	2 mVp-p or less	13 P09 pin No. 14																
+ 5 V	3 mVp-p or less	13 P09 pin No. 8																
Setting	Stop the sweep by setting HORIZ mode to SINGLE.																	
Check	Connect 1 : 1 prove to test oscilloscope, measure the ripple voltage of each power supply, and check that it is within rating.																	
Test point	13P09 Pin 1Pin 15 																	

4-7-3 CRT Cathode Voltage

Item	Description										
Rating	The voltage between CRT cathode and ground must be $-1.75\text{ kV} \pm 5\%$.										
Measurement location and adjustment location	<table><tr><th rowspan="2">Measurement location</th><th colspan="2">Adjustment location</th></tr><tr><th>Circuit symbol</th><th>Name</th></tr><tr><td>Between CRT cathode and GND</td><td>12R18</td><td>HV ADJ</td></tr></table>			Measurement location	Adjustment location		Circuit symbol	Name	Between CRT cathode and GND	12R18	HV ADJ
Measurement location	Adjustment location										
	Circuit symbol	Name									
Between CRT cathode and GND	12R18	HV ADJ									
Inspection and adjustment adjustment	1. Measure the voltage between the CRT cathode and ground with a digital voltage meter (using high voltage probe) and check that it is $-1.75\text{ kV} \pm 5\%$. 2. If it is not within rating, adjust with 12R18 HV ADJ. Note If the voltage between the CRT cathode and ground is within $\pm 5\%$ of rating, than adjustment is not required except when performing overall calibration.										
Adjustment location	 12R18 HV ADJ										

4-7-4 Intensity

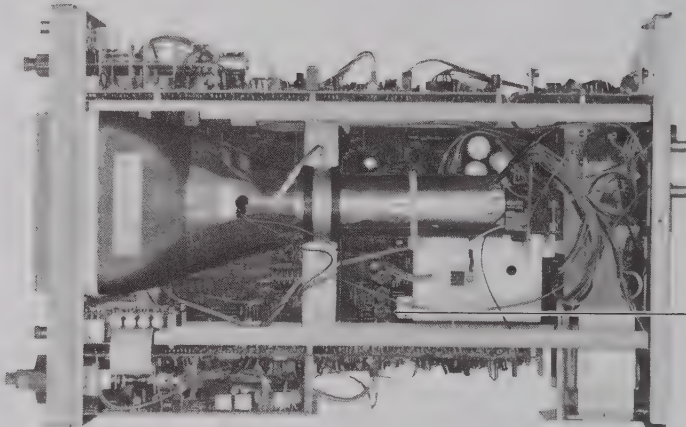
Item	Description																																	
Rating	With INTEN being set midrange, the proper intensity trace must appear; with the INTEN full counter-clockwise turn, the trace must disappear.																																	
Setting and adjustment location	<table><tr><th rowspan="2">Inspection order</th><th colspan="2">SS-5706</th><th rowspan="2">Trace or spot</th><th colspan="2">Adjustment location</th></tr><tr><th>HORIZ DISPLAY</th><th>INTEN position</th><th>Circuit symbol</th><th>Name</th></tr><tr><td>1</td><td rowspan="3">A</td><td>Midrange</td><td>Proper trace can be observed.</td><td rowspan="3">12R31</td><td rowspan="3">INTEN ADJ</td></tr><tr><td>2</td><td>Full counter-clockwise turn</td><td>Trace disappears</td></tr><tr><td>3</td><td>Full counter clockwise turn them 60° clockwise</td><td>Trace appears</td></tr><tr><td>4</td><td>X-Y</td><td>Full clockwise turn</td><td>Proper spot appears</td><td></td><td></td></tr></table> 1. Center 2. All the way counter clockwise 3. 60° from all the way counter clockwise 4. All the way clockwise						Inspection order	SS-5706		Trace or spot	Adjustment location		HORIZ DISPLAY	INTEN position	Circuit symbol	Name	1	A	Midrange	Proper trace can be observed.	12R31	INTEN ADJ	2	Full counter-clockwise turn	Trace disappears	3	Full counter clockwise turn them 60° clockwise	Trace appears	4	X-Y	Full clockwise turn	Proper spot appears		
Inspection order	SS-5706		Trace or spot	Adjustment location																														
	HORIZ DISPLAY	INTEN position		Circuit symbol	Name																													
1	A	Midrange	Proper trace can be observed.	12R31	INTEN ADJ																													
2		Full counter-clockwise turn	Trace disappears																															
3		Full counter clockwise turn them 60° clockwise	Trace appears																															
4	X-Y	Full clockwise turn	Proper spot appears																															
Check and adjustment	If the check result shows an improper intensity, adjust it with 12R31 INTEN ADJ.																																	
Adjustment location	 R12R31 INTEN ADJ																																	

R12R31
INTEN ADJ

4-7-5 Focus

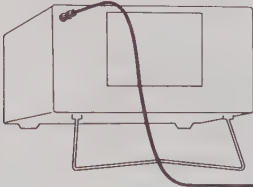
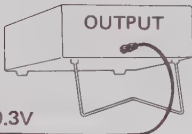
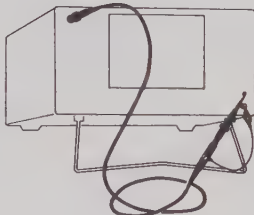
Item	Description															
Rating	Best focus must be obtainable by adjusting FOCUS when a waveform with an 8 div amplitude is displayed and set to the center with INTEN.															
	SS-5706 SG (SC-340) CH1 INPUT Output 1kHz Coaxial Cable															
Setting and adjustment location	<table><tr><th colspan="2">Input signal</th><th rowspan="2">Displayed amplitude</th><th colspan="2">Adjustment location</th></tr><tr><th>Waveform</th><th>Frequency</th><th>Circuit symbol</th><th>Name</th></tr><tr><td>Sinewave</td><td>1 kHz</td><td>8 div</td><td>12R37</td><td>ASTIG</td></tr></table>		Input signal		Displayed amplitude	Adjustment location		Waveform	Frequency	Circuit symbol	Name	Sinewave	1 kHz	8 div	12R37	ASTIG
Input signal		Displayed amplitude	Adjustment location													
Waveform	Frequency		Circuit symbol	Name												
Sinewave	1 kHz	8 div	12R37	ASTIG												
Check and adjustment	Check that the best focus can be obtained by adjusting FOCUS. If not, adjust focus with 12R37 ASITG.															
Amplitude on CRT screen	Correct focus	Incorrect focus														

4-7-5 Focus (cont.)

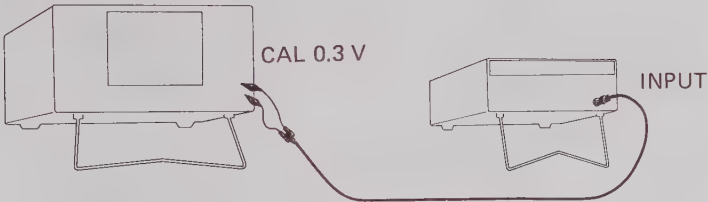
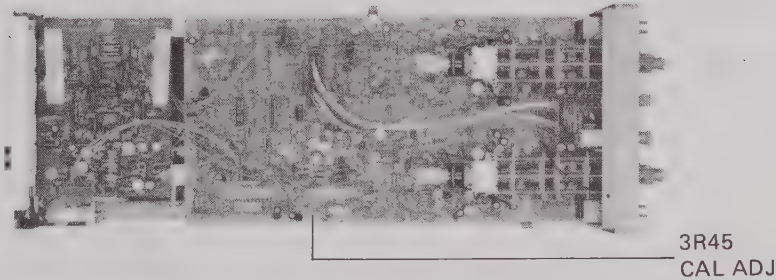
Item	Description
Adjustment location	 12R37 ASTIG

4-8 CALIBRATOR OUTPUT CHECK AND ADJUSTMENT

4-8-1 Output Voltage

Item	Description																												
Rating	0.3 V ± 1%																												
Connection	SS-5706 CH1 INPUT  SG (SC-340) OUTPUT   1kHz 0.3V Coaxial Cable Figure 4-8-1	SS-5706 CH1 INPUT  CAL 0.3V Figure 4-8-2																											
Setting	<table><tr><th colspan="2">SS5705</th><th colspan="3">Input signal</th><th rowspan="2">Amplitude on CRT screen</th><th colspan="2">Calibrator</th></tr><tr><th>Channel</th><th>VOLTS/DIV</th><th>Voltage</th><th>Waveform</th><th>Frequency</th><th>Circuit symbol</th><th>Name</th></tr><tr><td rowspan="2">CH1</td><td rowspan="2">20mV</td><td>0.3V</td><td>Square wave</td><td>1kHz</td><td>6 div ± 2%</td><td rowspan="2">3R45</td><td rowspan="2">CAL ADJ</td></tr><tr><td></td><td>CAL</td><td></td><td>6 div ± 1%</td></tr></table>		SS5705		Input signal			Amplitude on CRT screen	Calibrator		Channel	VOLTS/DIV	Voltage	Waveform	Frequency	Circuit symbol	Name	CH1	20mV	0.3V	Square wave	1kHz	6 div ± 2%	3R45	CAL ADJ		CAL		6 div ± 1%
SS5705		Input signal			Amplitude on CRT screen	Calibrator																							
Channel	VOLTS/DIV	Voltage	Waveform	Frequency		Circuit symbol	Name																						
CH1	20mV	0.3V	Square wave	1kHz	6 div ± 2%	3R45	CAL ADJ																						
			CAL		6 div ± 1%																								
Chack and adjustment	1. Make connection as shown in Figure 4-8-1 and adjust VARIABLE so that the amplitude on CRT screen is 6 div ± 0%. Reconnect as shown in Figure 4-8-2 and check that the displayed amplitude is the same as for Figure 4-8-1. 2. If the check result is outside the rated values, adjust is with 3R45 CAL ADJ.																												

4-8-2 Repetition Rate

Item	Description	
Rating	1 kHz $\pm$ 1%	
Connection	SS-5706	SC-7101
		
Check	Check that the count is between 990 Hz and 1010 Hz	
Adjustment location		

4-9 VERTICAL DEFLECTION SYSTEM CHECK AND ADJUSTMENT

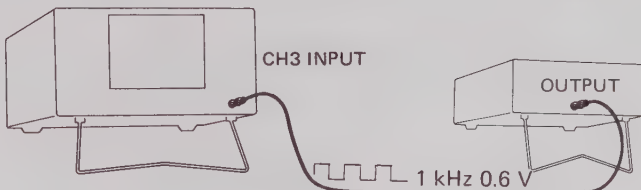
4-9-1 CH1–CH2 Deflection Factor

Item	Description																																																																		
Rating	At x 1: ± 2% At x 5: ± 4%																																																																		
Connection	SS-5706 CH1 INPUT CH2 INPUT SG (SC-340) OUTPUT 1kHz Coaxial Cable																																																																		
Setting	<table><tr><th rowspan="2">Sequ- ence</th><th colspan="2">SS-5706</th><th colspan="3">Input signal</th><th rowspan="2">Amplitude on CRT screen</th><th colspan="2">Calibrator</th></tr><tr><th>Channel</th><th>VOLTS/ DIV</th><th>Voltage</th><th>Waveform</th><th>Frequency</th><th>Circuit No.</th><th>Name</th></tr><tr><td>1</td><td>CH1 CH2</td><td>5 mV</td><td>30 mV</td><td rowspan="13">Square wave</td><td rowspan="13">1 kHz</td><td>6 div ± 2%</td><td>1R17 2R17</td><td>CH1 x 1 GAIN CH2 x 1 GAIN</td></tr><tr><td>2</td><td>CH1</td><td>1 mV(x5)</td><td>5 mV</td><td>6 div ± 4%</td><td>1R23</td><td>CH1 x 5 GAIN</td></tr><tr><td rowspan="11">3</td><td rowspan="11">CH1 • CH2</td><td>2MV(x5)</td><td>12 mV</td><td rowspan="11">6 div ±2%</td><td rowspan="11">—</td><td rowspan="11">—</td></tr><tr><td>10 mV</td><td>60 mV</td></tr><tr><td>20 mV</td><td>120 mV</td></tr><tr><td>50 mV</td><td>0.3 V</td></tr><tr><td>0.1 V</td><td>0.6 V</td></tr><tr><td>0.2 V</td><td>1.2 V</td></tr><tr><td>0.5 V</td><td>3 V</td></tr><tr><td>1 V</td><td>6 V</td></tr><tr><td>2 V</td><td>12 V</td></tr><tr><td>5 V</td><td>30 V</td></tr><tr><td>10 V</td><td>60 V</td></tr></table>								Sequ- ence	SS-5706		Input signal			Amplitude on CRT screen	Calibrator		Channel	VOLTS/ DIV	Voltage	Waveform	Frequency	Circuit No.	Name	1	CH1 CH2	5 mV	30 mV	Square wave	1 kHz	6 div ± 2%	1R17 2R17	CH1 x 1 GAIN CH2 x 1 GAIN	2	CH1	1 mV(x5)	5 mV	6 div ± 4%	1R23	CH1 x 5 GAIN	3	CH1 • CH2	2MV(x5)	12 mV	6 div ±2%	—	—	10 mV	60 mV	20 mV	120 mV	50 mV	0.3 V	0.1 V	0.6 V	0.2 V	1.2 V	0.5 V	3 V	1 V	6 V	2 V	12 V	5 V	30 V	10 V	60 V
Sequ- ence	SS-5706		Input signal			Amplitude on CRT screen	Calibrator																																																												
	Channel	VOLTS/ DIV	Voltage	Waveform	Frequency		Circuit No.	Name																																																											
1	CH1 CH2	5 mV	30 mV	Square wave	1 kHz	6 div ± 2%	1R17 2R17	CH1 x 1 GAIN CH2 x 1 GAIN																																																											
2	CH1	1 mV(x5)	5 mV			6 div ± 4%	1R23	CH1 x 5 GAIN																																																											
3	CH1 • CH2	2MV(x5)	12 mV			6 div ±2%	—	—																																																											
		10 mV	60 mV																																																																
		20 mV	120 mV																																																																
		50 mV	0.3 V																																																																
		0.1 V	0.6 V																																																																
		0.2 V	1.2 V																																																																
		0.5 V	3 V																																																																
		1 V	6 V																																																																
		2 V	12 V																																																																
		5 V	30 V																																																																
		10 V	60 V																																																																

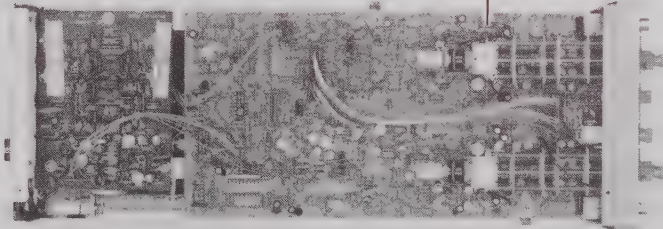
4-9-1 Deflection Factor (CH1 ÷ CH2) (Cont.)

Item	Description
Check and adjustment	1. Check that amplitude of CRT waveform is within ±2%. If the check result shows that CH1 has a great error, adjust 1R17 CH1 X1 GAIN; if CH2 has a great error, adjust 2R17 CH2 X1 GAIN. 2. Pull VOLTS/DIV VARIABLE (PULL x5 MAG) and set input sensitivity to 1mV and input voltage to 6mV. If the check reslt shows that CH1 has a great error, adjust 1R23 CH1 x 5 GAIN. 3. Then check the amplitude by switching VOLTS/DIV and AMPLITUDE. PRECAUTION By adjusting items 1 and 2, the 2mV, 10mV, and succeeding ranges can be set within the rated values.
Adjustment location	1R17 CH 1 GAIN 1R23 CH 1 X5 GAIN ADJ 2R23 CH 2 X5 GAIN 2R17 CH 2 GAIN

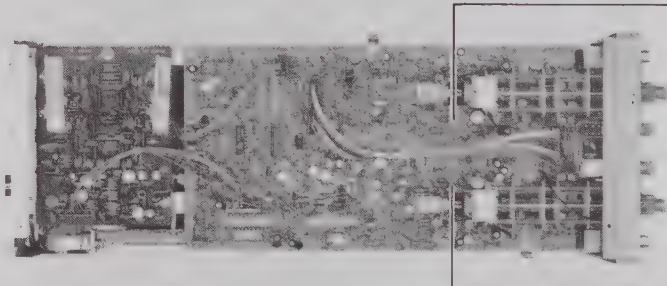
4-9-2 CH3 Deflection Factor

Item	Description																							
Connection	SS-5706 SG (SC-340) 																							
Setting and adjustment location	<table><tr><th colspan="2">SS-5706</th><th colspan="3">Input signal</th><th rowspan="2">Displayed amplitude</th><th colspan="2">Adjustment location</th></tr><tr><th>Channel</th><th>MODE (vertical)</th><th>Voltage</th><th>Waveform</th><th>Frequency</th><th>Circuit symbol</th><th>Name</th></tr><tr><td>CH3</td><td>TRI</td><td>0.6 V</td><td>Square wave</td><td>1 kHz</td><td>6 div $\pm$ 3%</td><td>3R11</td><td>CH3 GAIN</td></tr></table>	SS-5706		Input signal			Displayed amplitude	Adjustment location		Channel	MODE (vertical)	Voltage	Waveform	Frequency	Circuit symbol	Name	CH3	TRI	0.6 V	Square wave	1 kHz	6 div $\pm$ 3%	3R11	CH3 GAIN
SS-5706		Input signal			Displayed amplitude	Adjustment location																		
Channel	MODE (vertical)	Voltage	Waveform	Frequency		Circuit symbol	Name																	
CH3	TRI	0.6 V	Square wave	1 kHz	6 div $\pm$ 3%	3R11	CH3 GAIN																	
Adjustment method	Check that the displayed amplitude is 6 div $\pm$3%. If the error is great, adjust with 3R11 CH3 GAIN.																							
Adjustment location	 3R11 CH3 GAIN																							

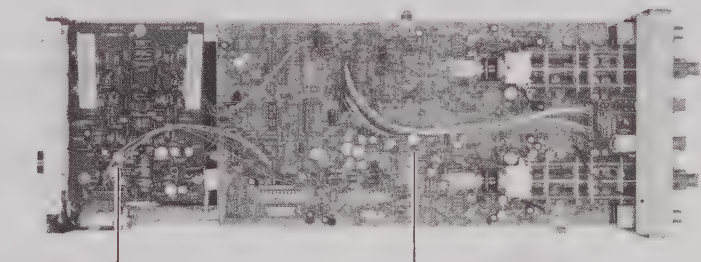
4-9-3 x5 MAG DC Balance

Item	Description												
Setting and adjustment location	<table><tr><th colspan="2">SS-5706</th><th colspan="2">Adjustment location</th></tr><tr><th>Channel</th><th>GND</th><th>Circuit symbol</th><th>Name</th></tr><tr><td>CH1</td><td>GND</td><td>1R03</td><td>ATTEN BAL</td></tr></table>	SS-5706		Adjustment location		Channel	GND	Circuit symbol	Name	CH1	GND	1R03	ATTEN BAL
SS-5706		Adjustment location											
Channel	GND	Circuit symbol	Name										
CH1	GND	1R03	ATTEN BAL										
Adjustment method	Replace pull x5 MAG by push-pull and check that the trace does not move. If CH1 mores, adjust it with 1R03 ATTEN BAL. Note The (PULL x5 MG) function for SS-5706 is limited to CH1												
Adjustment location	 1R03 CH 1 ATTEN BAL												

4-9-4 VARIABLE Balance

Item	Description															
Setting and adjustment location	<table><tr><th colspan="2">SS-5706</th><th colspan="2">Adjustment location</th></tr><tr><th>Channel</th><th>GND</th><th>Circuit symbol</th><th>Name</th></tr><tr><td>CH1</td><td rowspan="2">GND</td><td>1R13</td><td>CH1 VARI BAL</td></tr><tr><td>CH2</td><td>2R23</td><td>CH2 VARI BAL</td></tr></table>	SS-5706		Adjustment location		Channel	GND	Circuit symbol	Name	CH1	GND	1R13	CH1 VARI BAL	CH2	2R23	CH2 VARI BAL
SS-5706		Adjustment location														
Channel	GND	Circuit symbol	Name													
CH1	GND	1R13	CH1 VARI BAL													
CH2		2R23	CH2 VARI BAL													
Adjustment method	Change VARIABLE and check that the trace does not move. If CH1 moves, adjust it with 1R13 CH1 VARI BAL; if CH2 moves, adjust it with 2R23 CH2 VARI BAL;															
	Note Also check x5 balance and VARIABLE balance after performing adjustments described in section "4-9-1 CH1—CH2 Deflection Factor."															
Adjustment location	 1R13 CH 1 VARI BAL 2R13 CH 2 VARI BAL															

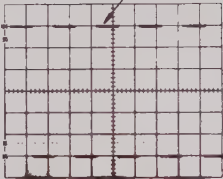
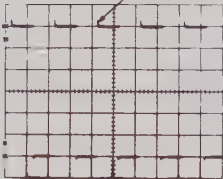
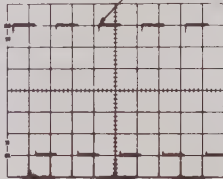
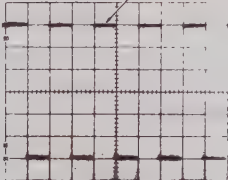
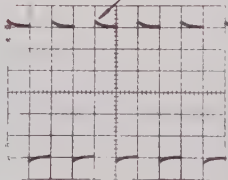
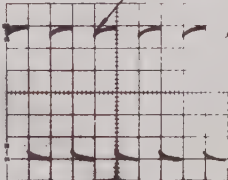
4-9-5 CH2 Polarity Switching Balance

Item	Description				
Setting and Adjustment Location	Adjustment Sequence	SS-5706		Adjustment Location	
		Channel	GND	Circuit Symbol	Name
	1	CH2	GND	2R29	POS CENT
	2			4R56	POS CENT
Adjustment Sequence	1. Set the bright horizontal line at the center of the screen with CH2 POSITION (PULL INV). 2. Check that the movement of the bright line is ± 1.5 div when CH2 POSITION (PULL INV) is pressed. If the displacement of the bright line is great, adjust 2R29 CH2 POS CENT so that it becomes minimum. 3. Set the bright line with CH2 POSITION (PULL INV) so that it does not move when CH2 POSITION (PULL INV) is pushed or pulled. 4. Adjust 4R56 POS CENT so that the bright line is at the center of the horizontal scale.				
Adjustment location	 4R56 POL BAL 2R29 POS CENT				

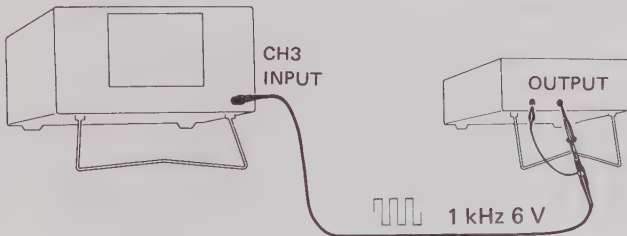
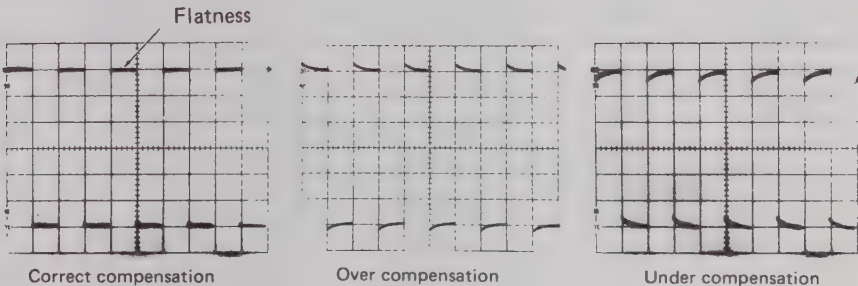
4-9-6 CH1–CH2 Attenuator Phase and Probe Phase

Item	Description																																																																
Rating	Attenautor phase Within ±3% Probe phase Within ±3%																																																																
Connection	SS-5706 CH1 INPUT CH2 INPUT SG (SC-340) OUTPUT 1kHz 0.3V																																																																
Setting and adjustment location	<table><tr><th rowspan="2">Sequence</th><th rowspan="2">SS-5706 Channel</th><th colspan="3">Input signal</th><th rowspan="2">Amplitude on CRT screen</th><th rowspan="2">Adjustment location</th><th rowspan="2">Remarks</th></tr><tr><th>Voltage</th><th>Waveform</th><th>Frequency</th></tr><tr><td>1</td><td>CH1</td><td>0.3 V</td><td rowspan="2">Square wave</td><td rowspan="3">1 kHz</td><td>6 div</td><td>—</td><td rowspan="2">Adjust with the attached SS-0060 probe</td></tr><tr><td>2</td><td>CH2</td><td>Set to VOLTS/DIV</td><td>Amplitude easy to observe</td><td>See the table below</td></tr></table> <table><tr><th rowspan="2">VOLTS/DIV</th><th colspan="2">CH1</th><th colspan="2">CH2</th></tr><tr><th>ATT phase adjuster</th><th>Probe phase adjuster</th><th>ATT phase adjuster</th><th>Probe phase adjuster</th></tr><tr><td>10 mV</td><td>0C05</td><td>0C04</td><td>0C25</td><td>0C24</td></tr><tr><td>20 mV</td><td>0C07</td><td>0C06</td><td>0C27</td><td>0C26</td></tr><tr><td>50 mV to 0.2 V</td><td>0C09</td><td>0C08</td><td>0C29</td><td>0C28</td></tr><tr><td>0.5 V to 2 V</td><td>0C13</td><td>0C12</td><td>0C33</td><td>0C32</td></tr><tr><td>5V, 10V</td><td>0C17</td><td>0C16</td><td>0C37</td><td>0C36</td></tr></table>							Sequence	SS-5706 Channel	Input signal			Amplitude on CRT screen	Adjustment location	Remarks	Voltage	Waveform	Frequency	1	CH1	0.3 V	Square wave	1 kHz	6 div	—	Adjust with the attached SS-0060 probe	2	CH2	Set to VOLTS/DIV	Amplitude easy to observe	See the table below	VOLTS/DIV	CH1		CH2		ATT phase adjuster	Probe phase adjuster	ATT phase adjuster	Probe phase adjuster	10 mV	0C05	0C04	0C25	0C24	20 mV	0C07	0C06	0C27	0C26	50 mV to 0.2 V	0C09	0C08	0C29	0C28	0.5 V to 2 V	0C13	0C12	0C33	0C32	5V, 10V	0C17	0C16	0C37	0C36
Sequence	SS-5706 Channel	Input signal			Amplitude on CRT screen	Adjustment location	Remarks																																																										
		Voltage	Waveform	Frequency																																																													
1	CH1	0.3 V	Square wave	1 kHz	6 div	—	Adjust with the attached SS-0060 probe																																																										
2	CH2	Set to VOLTS/DIV			Amplitude easy to observe	See the table below																																																											
VOLTS/DIV	CH1		CH2																																																														
	ATT phase adjuster	Probe phase adjuster	ATT phase adjuster	Probe phase adjuster																																																													
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0.5 V to 2 V	0C13	0C12	0C33	0C32																																																													
5V, 10V	0C17	0C16	0C37	0C36																																																													

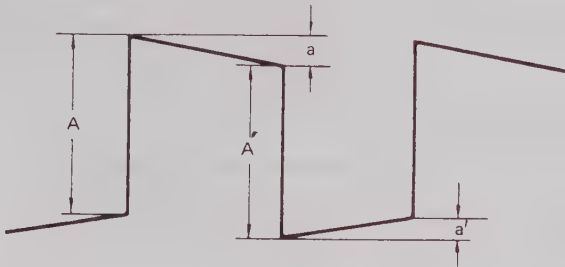
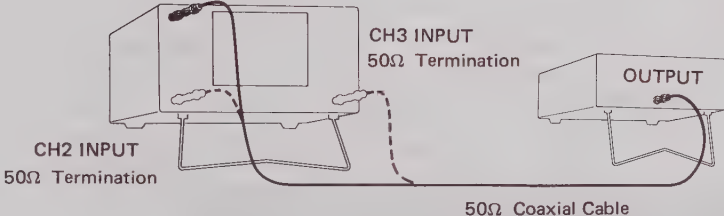
4-9-6 CH1–CH2 Attenuator Phase and Probe Phase (con.)

Item	Description
Adjustment	1. Use the probe phase adjuster to adjust as shown in the figure. 2. Switch VOLTS/DIV and input voltage and adjust the attenuator and probe phases.
CRT waveform	Through compensation Flatness  (a) Proper Overshoot  (b) Improper (overcompensation) Roundness  (c) Improper (undercompensation) Probe compensation Flatness  (a) Proper Overshoot  (b) Improper (overcompensation) Roundness  (c) Improper (undercompensation)

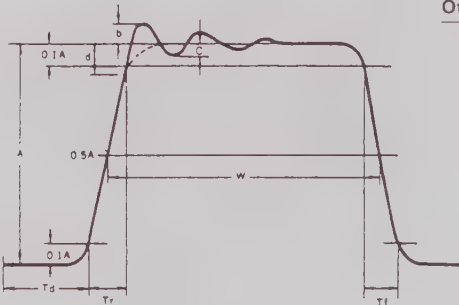
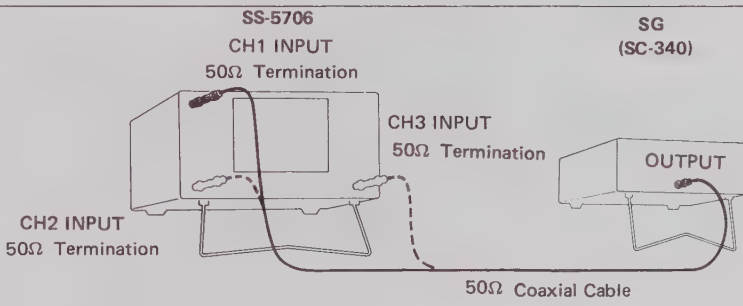
4-9-7 CH3 Probe Phase

Item	Description																
Rating	Probe phase $\pm 3\%$ or less																
Connection	SS-5706 SG (SC-340) 																
Setting	<table><tr><th>SS-5706</th><th colspan="3">Input Signal</th><th rowspan="2">Displayed amplitude</th><th rowspan="2">Remark</th></tr><tr><th>(V)MODE</th><th>Voltage</th><th>Waveform</th><th>Frequency</th></tr><tr><td>TRI</td><td>6V</td><td>Square wave</td><td>1 kHz</td><td>5 div</td><td>Adjust with attached SS-0060 probe</td></tr></table>	SS-5706	Input Signal			Displayed amplitude	Remark	(V)MODE	Voltage	Waveform	Frequency	TRI	6V	Square wave	1 kHz	5 div	Adjust with attached SS-0060 probe
SS-5706	Input Signal			Displayed amplitude	Remark												
(V)MODE	Voltage	Waveform	Frequency														
TRI	6V	Square wave	1 kHz	5 div	Adjust with attached SS-0060 probe												
Adjustment	Check that the flatness f the CH3 square wave is appropriate after adjusting the probe phase.																
Displayed waveform	Probe phase waveform 																

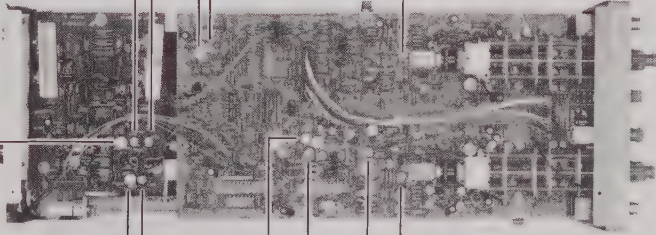
4-9-8 Square Wave Response I (Sag)

Item	Description																		
Rating	CH 1 • CH2 (5mV/DIV): 2% (10°C ~ 35°C) CH3: 3% (10°C ~ 35°C)  A: Basic amplitude: sag a/A (or a'/A') × 100% a: Sag: Take the greater value of a/A and a'/A'																		
Connection	SS-5706 CH1 INPUT 50Ω Termination SG (SC-340) 																		
Setting	<table><tr><th rowspan="2">Sequence</th><th rowspan="2">SS-5706 Channel</th><th colspan="3">Input signal</th><th rowspan="2">Amplitude on CRT screen</th></tr><tr><th>Voltage</th><th>Waveform</th><th>Frequency</th></tr><tr><td>1</td><td>CH • CH2</td><td>30mV</td><td rowspan="2">Square wave</td><td rowspan="2">1 kHz, and 250kHz</td><td rowspan="2">6 div</td></tr><tr><td>2</td><td>CH3</td><td>600mV</td></tr></table>	Sequence	SS-5706 Channel	Input signal			Amplitude on CRT screen	Voltage	Waveform	Frequency	1	CH • CH2	30mV	Square wave	1 kHz, and 250kHz	6 div	2	CH3	600mV
Sequence	SS-5706 Channel			Input signal				Amplitude on CRT screen											
		Voltage	Waveform	Frequency															
1	CH • CH2	30mV	Square wave	1 kHz, and 250kHz	6 div														
2	CH3	600mV																	
Check	1. Set AC-DC to DC. 2. Check the CH3 in the same way. 3. Set the waveform to the center of the display and check CH3 sag.																		

4-9-9 Square Wave Response II (Overshoot and Other Waveform Distortions)

Item	Description																					
Rating	(10° C to 35° C)																					
	Waveform distortion	Channel																				
		CH1 + CH2 (5mV/div)	(0.1V/div)																			
	Overshoot	7%	10%																			
	Other distortion	5%	9%																			
																						
A: Basic amplitude Tr: Rise time																						
$\frac{b}{A}$: Overshoot Tf: Fall time																						
$\frac{c}{A}$: Ringing $\frac{d}{A}$: Roundness																						
W: Pulse width Td: Signal delay time																						
Connection																						
Setting	<table><tr><th rowspan="2">Sequence</th><th rowspan="2">SS-5706 Channel</th><th colspan="2">Input signal</th><th rowspan="2">Frequency</th><th rowspan="2">Amplitude on CRT screen</th></tr><tr><th>Voltage</th><th>Waveform</th></tr><tr><td>1</td><td>CH1 + CH2</td><td>30mV</td><td rowspan="2">Pulse</td><td rowspan="2">100 kHz</td><td rowspan="2">6 div</td></tr><tr><td>2</td><td>CH3</td><td>600mV</td></tr></table>					Sequence	SS-5706 Channel	Input signal		Frequency	Amplitude on CRT screen	Voltage	Waveform	1	CH1 + CH2	30mV	Pulse	100 kHz	6 div	2	CH3	600mV
Sequence	SS-5706 Channel	Input signal		Frequency	Amplitude on CRT screen																	
		Voltage	Waveform																			
1	CH1 + CH2	30mV	Pulse	100 kHz	6 div																	
2	CH3	600mV																				
Check and adjustment	1. Adjust output voltage, display a waveform with amplitude of 6 divisions and check overshoot and other distortions. If the result does not satisfy the rating, adjust CH1 overshoot and other distortion according to the displayed waveform and table on the next page. 2. Check CH2 and if it does not satisfy the rating, adjust it according to the displayed waveform and table on the next page. 3. Check CH3 and if it does not satisfy the rating, adjust it according to the displayed waveform and table on the next page.																					

4-9-9 Square Wave Response II (Overshoot and Other Waveform Distortion) (cont.)

Item	Description																																																
	Note After performing calibration described in section “4-9-9 Square Wave Response II,” perform the inspections described in section “4-9-10 Frequency Bandwidth.”																																																
Adjustment	<table><tr><th colspan="2">CH1 Pre-amplifier</th><th colspan="2">CH2 Pre-amplifier</th><th colspan="2">Main amplifier</th><th colspan="2">DELAY CABLE DRIVER</th><th colspan="2">CH3 Pre-amplifier</th></tr><tr><th>Capacitor</th><th>Resistor</th><th>Capacitor</th><th>Resistor</th><th>Capacitor</th><th>Resistor</th><th>Capacitor</th><th>Resistor</th><th>Capacitor</th><th>Resistor</th></tr><tr><td>1C06</td><td>—</td><td>2C 06</td><td rowspan="3">—</td><td>4C 03</td><td>4R 05</td><td>3C 06</td><td>3R 26</td><td>3C 02</td><td>3R 06</td></tr><tr><td></td><td></td><td>2C 50</td><td>4C 05</td><td>4R 16</td><td></td><td></td><td>3C 03</td><td></td></tr><tr><td></td><td></td><td></td><td>4C 07</td><td></td><td></td><td></td><td></td><td></td></tr></table>	CH1 Pre-amplifier		CH2 Pre-amplifier		Main amplifier		DELAY CABLE DRIVER		CH3 Pre-amplifier		Capacitor	Resistor	Capacitor	Resistor	Capacitor	Resistor	Capacitor	Resistor	Capacitor	Resistor	1C06	—	2C 06	—	4C 03	4R 05	3C 06	3R 26	3C 02	3R 06			2C 50	4C 05	4R 16			3C 03					4C 07					
CH1 Pre-amplifier		CH2 Pre-amplifier		Main amplifier		DELAY CABLE DRIVER		CH3 Pre-amplifier																																									
Capacitor	Resistor	Capacitor	Resistor	Capacitor	Resistor	Capacitor	Resistor	Capacitor	Resistor																																								
1C06	—	2C 06	—	4C 03	4R 05	3C 06	3R 26	3C 02	3R 06																																								
		2C 50		4C 05	4R 16			3C 03																																									
				4C 07																																													
Adjustment location	3C06 9R26 4C07 4R05 4R16 4R05 4C03  1C06 2C06 2C50 3C02 3R11																																																

4-9-10 Bandwidth

Item	Description																																									
Rating	CH1 • CH2 5mV/div to 1V/div DC to 30MHz -3dB 1mV/div, 2mV/div DC to 10MHz -3dB CH3 0.1V/div DC to 30MHz -3dB																																									
Connection	SS-5706 CH1 INPUT CH2 INPUT CH3 INPUT SG (SC-340) OUTPUT Coaxial Cable																																									
Setting	<table><tr><th rowspan="2">Sequence</th><th colspan="2">SS-5706</th><th colspan="3">Input signal</th><th rowspan="2">Amplitude on CRT screen</th></tr><tr><th>Channel</th><th>VOLTS/DIV</th><th>Voltage</th><th>Waveform</th><th>Frequency</th></tr><tr><td>1</td><td rowspan="4">CH1 • CH2</td><td rowspan="2">5mV</td><td rowspan="2">30mV</td><td rowspan="6">sine</td><td>50kHz</td><td>6 div</td></tr><tr><td>2</td><td>30MHz</td><td>4.25 div or more</td></tr><tr><td>3</td><td rowspan="2">1mV</td><td colspan="2" rowspan="2">6mV</td><td>50kHz</td><td>6 div</td></tr><tr><td>4</td><td>30MHz</td><td>4.25 div or more</td></tr><tr><td>5</td><td rowspan="2">CH3</td><td rowspan="2">0.1V</td><td colspan="2" rowspan="2">0.6V</td><td>50kHz</td><td>6 div</td></tr><tr><td>6</td><td>30MHz</td><td>4.25 div or more</td></tr></table>	Sequence	SS-5706		Input signal			Amplitude on CRT screen	Channel	VOLTS/DIV	Voltage	Waveform	Frequency	1	CH1 • CH2	5mV	30mV	sine	50kHz	6 div	2	30MHz	4.25 div or more	3	1mV	6mV		50kHz	6 div	4	30MHz	4.25 div or more	5	CH3	0.1V	0.6V		50kHz	6 div	6	30MHz	4.25 div or more
Sequence	SS-5706		Input signal			Amplitude on CRT screen																																				
	Channel	VOLTS/DIV	Voltage	Waveform	Frequency																																					
1	CH1 • CH2	5mV	30mV	sine	50kHz	6 div																																				
2					30MHz	4.25 div or more																																				
3		1mV	6mV		50kHz	6 div																																				
4					30MHz	4.25 div or more																																				
5	CH3	0.1V	0.6V		50kHz	6 div																																				
6					30MHz	4.25 div or more																																				
Check	1. Set the base frequency to 50 kHz, adjust the output voltage of signal generator, and display a waveform with 6 division amplitude in the center of the screen. 2. Check that the displayed amplitude is 4.25 divisions or more (-3 dB amplitude for 6 div) when the frequency of the signal generator is switched sequentially through the rated frequencies. Reference If the frequency bandwidth is not within rating, perform the adjustment described in section “4-9-9 Square Wave Response.” In this case, the tip of the waveform must be made to rise sharply in order to obtain good bandwidth.																																									

4-9-11 Linearity

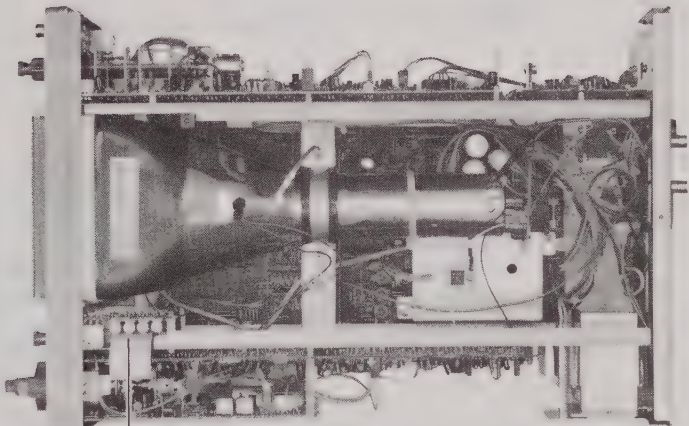
Item	Description															
Rating	Within ± 5% (at 1 kHz)															
Connection	SS-5706 CH1 INPUT CH2 INPUT CH3 INPUT SG (SC-340) 1kHz/30MHz Coaxial Cable															
Setting and adjustment location	<table><tr><th>SS-5706</th><th colspan="3">Input signal</th><th>Amplitude on CRT screen</th></tr><tr><th>Channel</th><th>Voltage</th><th>Waveform</th><th>Frequency</th><th></th></tr><tr><td>CH • CH2</td><td>10 mV</td><td>sine</td><td>1 kHz, 30 MHz</td><td>2 div</td></tr></table>	SS-5706	Input signal			Amplitude on CRT screen	Channel	Voltage	Waveform	Frequency		CH • CH2	10 mV	sine	1 kHz, 30 MHz	2 div
SS-5706	Input signal			Amplitude on CRT screen												
Channel	Voltage	Waveform	Frequency													
CH • CH2	10 mV	sine	1 kHz, 30 MHz	2 div												
Check	1. Display a 1 kHz sine wave with 2 division amplitude at the center of the screen. 2. Adjust ⬆ POSITION to move the waveform to the topmost and bottommost 2 divisions and check that the change in amplitude is ±3% or less. 3. Change the input signal frequency to 30MHz and check again according to procedures 1 and 2 above.															
CRT wave form	2 div The top line The center line The bottom line															

4-10 TRIGGER SYSTEM CHECK AND ADJUSTMENT

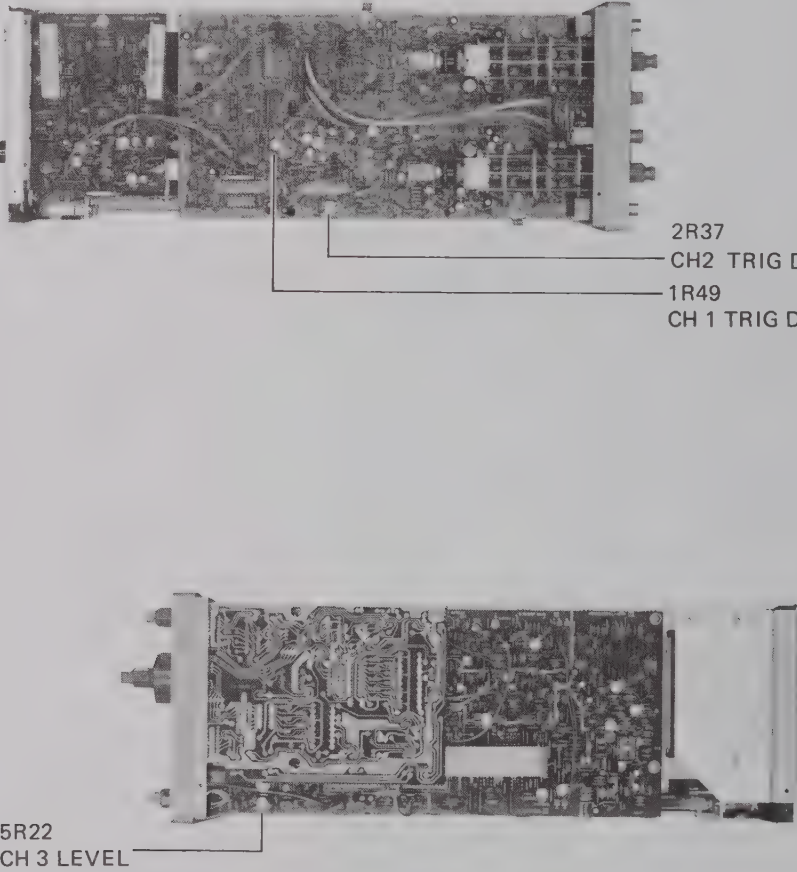
4-10-1 Triggering (CH1, CH2, and CH3)

Item	Description																																																														
Rating	(10°C to 35°C)																																																														
	Frequency range	Level																																																													
		CH1, CH2		CH3																																																											
	DC to 5 MHz	0.5 div		1.0 div																																																											
	5 MHz to 30 MHz	1.5 div		3.0 div																																																											
Connection	SS-5706 CH1 INPUT CH2 INPUT CH3 INPUT SG (SC-340) OUTPUT 1kHz Coaxial Cable																																																														
Setting	<table><tr><th rowspan="2">Sequence</th><th rowspan="2">Item</th><th colspan="3">SS-5706</th><th colspan="3">Input signal</th><th rowspan="2">Ampli- tude on CRT screen</th><th colspan="2">Calibrator</th></tr><tr><th>VERT MODE</th><th>SOURCE</th><th>COUPLING</th><th>Voltage</th><th>Wave- form</th><th>Fre- quency</th><th>Circuit No.</th><th>Name</th></tr><tr><td>1</td><td rowspan="2">CH1 trigger</td><td rowspan="2">CH1</td><td rowspan="2">CH1</td><td>AC</td><td rowspan="2">10 mV</td><td rowspan="9">Sine</td><td rowspan="9">1 kHz</td><td rowspan="2">2 div</td><td>6R11</td><td>LEVEL ADJ</td></tr><tr><td>2</td><td>DC</td><td>1R49</td><td>CH1 TRIG DC BAL</td></tr><tr><td>3</td><td>CH2 trigger</td><td>CH2</td><td>CH2</td><td>DC</td><td>10 mV</td><td>2 div</td><td>2R37</td><td>CH2 TRIG DC BAL</td></tr><tr><td>4</td><td>CH3 trigger</td><td>TR1</td><td>CH3</td><td>AC</td><td>0.4 V</td><td>4 div</td><td>5R22</td><td>CH3 LEVEL</td></tr></table>											Sequence	Item	SS-5706			Input signal			Ampli- tude on CRT screen	Calibrator		VERT MODE	SOURCE	COUPLING	Voltage	Wave- form	Fre- quency	Circuit No.	Name	1	CH1 trigger	CH1	CH1	AC	10 mV	Sine	1 kHz	2 div	6R11	LEVEL ADJ	2	DC	1R49	CH1 TRIG DC BAL	3	CH2 trigger	CH2	CH2	DC	10 mV	2 div	2R37	CH2 TRIG DC BAL	4	CH3 trigger	TR1	CH3	AC	0.4 V	4 div	5R22	CH3 LEVEL
Sequence	Item	SS-5706			Input signal			Ampli- tude on CRT screen	Calibrator																																																						
		VERT MODE	SOURCE	COUPLING	Voltage	Wave- form	Fre- quency		Circuit No.	Name																																																					
1	CH1 trigger	CH1	CH1	AC	10 mV	Sine	1 kHz	2 div	6R11	LEVEL ADJ																																																					
2				DC					1R49	CH1 TRIG DC BAL																																																					
3	CH2 trigger	CH2	CH2	DC	10 mV			2 div	2R37	CH2 TRIG DC BAL																																																					
4	CH3 trigger	TR1	CH3	AC	0.4 V			4 div	5R22	CH3 LEVEL																																																					
Check	1. Check that the sweep start is close to the center of the signal amplitude when LEVEL is set to the middle. If it is not close to the center, adjust with 6R11 LEVEL ADJ. Check that “+” and “-” alternate when SLOPE is pushed and pulled. 2. Switch COUPLING to DC and check that synchronization is obtained at the same location as for AC in item 1. If the difference is great, adjust with 1R49 CH1 TRIG DC BAL.																																																														

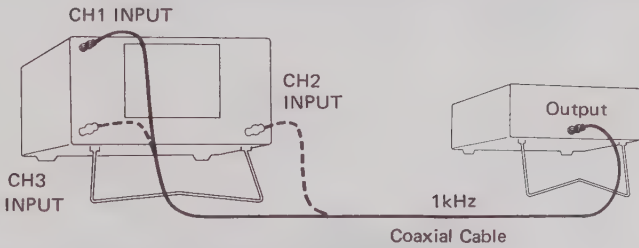
4-10-1 Triggering (CH1, CH2, and CH3) (cont.)

Item	Description
Check	3. Check that the sweep start point is the same when (V) MODE is set to CH2, SOURCE is set to CH2, and COUPLING is switched between AC and DC. If the difference is great, adjust with 2R37 CH2 TRIG DC BAL. 4. Check that the sweep start is at the center of horizontal scale when (V) MODE is set to TRI, SOURCE is set to CH3, and COUPLING is set to DC. If the difference is great, adjust with 5R22 CH3 LEVEL. REFERENCE CH2 TRIG DC BAL must be readjusted when CH1 TRIG DC BAL is adjusted.
Adjustment location	 6R11 LEVEL ADJ

4-10-1 Triggering (CH1, CH2, and CH3) (cont.)

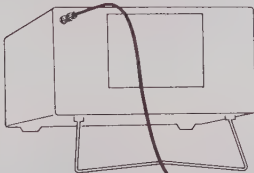
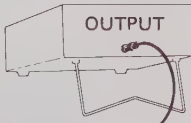
Item	Description
Adjustment location	 2R37 CH2 TRIG DC BAL 1R49 CH 1 TRIG DC BAL 5R22 CH 3 LEVEL

4-10-2 B triggering

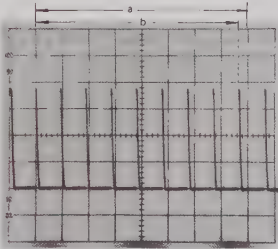
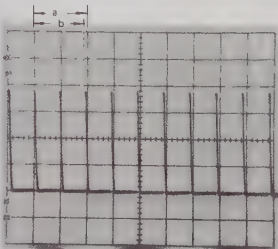
Item	Description																				
Rating	(10° C to 35° C) <table><tr><th rowspan="2">Frequency range</th><th colspan="2">Level</th></tr><tr><th>CH1, CH2</th><th>CH3</th></tr><tr><td>DC to 5 MHz</td><td>0.7 div</td><td>1.5 div</td></tr><tr><td>5 MHz to 20 MHz</td><td>2 div</td><td>4 div</td></tr></table>	Frequency range	Level		CH1, CH2	CH3	DC to 5 MHz	0.7 div	1.5 div	5 MHz to 20 MHz	2 div	4 div									
Frequency range	Level																				
	CH1, CH2	CH3																			
DC to 5 MHz	0.7 div	1.5 div																			
5 MHz to 20 MHz	2 div	4 div																			
Connection	SS-5706 SG (SC-340) 																				
Setting	<table><tr><th colspan="3">SS-5706</th><th colspan="3">Input signal</th><th rowspan="2">Amplitude on CRT screen</th></tr><tr><th>HORIZ DISPLAY</th><th>SOURCE</th><th>COUPLING</th><th>Voltage</th><th>Waveform</th><th>Frequency</th></tr><tr><td>B</td><td>CH1</td><td>AC</td><td>10 mV</td><td>Sine</td><td>1 kHz</td><td>2 div</td></tr></table>	SS-5706			Input signal			Amplitude on CRT screen	HORIZ DISPLAY	SOURCE	COUPLING	Voltage	Waveform	Frequency	B	CH1	AC	10 mV	Sine	1 kHz	2 div
SS-5706			Input signal			Amplitude on CRT screen															
HORIZ DISPLAY	SOURCE	COUPLING	Voltage	Waveform	Frequency																
B	CH1	AC	10 mV	Sine	1 kHz	2 div															
Check	Check that the sweep start is close to the center of the signal amplitude when LEVEL is set to the middle and “+” and “-” alternate when SLOPE is pushed and pulled.																				

4-11 HORIZONTAL DEFLECTION SYSTEM CHECK AND ADJUSTMENT

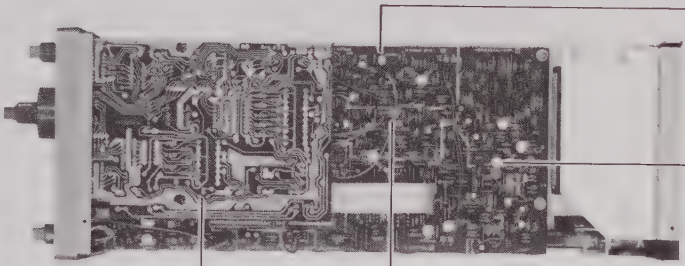
4-11-1 Sweep Rate

Item	Description																																															
Rating	A sweep																																															
	I. At screen center 8 div.: 0.1 μ s/div $\sim$ 0.5 S/div $\pm$ 2%																																															
	10 mS/div to 0.5 S/div $\pm$ 6%																																															
	II. At any 2 div within 8 div from the screen center: $\pm$ 5%																																															
	B sweep																																															
I. At screen center 8 div: $\pm$ 3%																																																
II. At any 2 div within 8 div from the screen center: $\pm$ 6%																																																
Connector	SS-5706 CH1 INPUT  SG (SC-340) OUTPUT  Coaxial Cable																																															
Setting	<table><tr><th rowspan="2">Sequence</th><th rowspan="2">Item</th><th colspan="2">SS-5706</th><th rowspan="2">Input signal</th><th rowspan="2">Amplitude on CRT screen</th><th colspan="2">Calibrator</th></tr><tr><th>HORIZ DISPLAY</th><th>TIME/DIV</th><th>Circuit No.</th><th>Name</th></tr><tr><td>1</td><td rowspan="3">A sweep</td><td rowspan="3">A</td><td>0.1 ms</td><td>0.1 ms</td><td rowspan="6">about 4 div</td><td>11R19</td><td>NORM GAIN</td></tr><tr><td>2</td><td>1 μs</td><td>1 μs</td><td>7C09</td><td>—</td></tr><tr><td>3</td><td>Range other than above</td><td>Set TIME/DIV</td><td>—</td><td>—</td></tr><tr><td>4</td><td rowspan="3">B sweep</td><td rowspan="3">B (DLY'D)</td><td>0.1 ms</td><td>0.1 ms</td><td>10R18</td><td>B TIMING ADJ</td></tr><tr><td>5</td><td>1 μs</td><td>1 μs</td><td>8C11</td><td>—</td></tr><tr><td>6</td><td>Range other than above</td><td>Set TIME/DIV</td><td>—</td><td>—</td></tr></table>	Sequence	Item	SS-5706		Input signal	Amplitude on CRT screen	Calibrator		HORIZ DISPLAY	TIME/DIV	Circuit No.	Name	1	A sweep	A	0.1 ms	0.1 ms	about 4 div	11R19	NORM GAIN	2	1 μ s	1 μ s	7C09	—	3	Range other than above	Set TIME/DIV	—	—	4	B sweep	B (DLY'D)	0.1 ms	0.1 ms	10R18	B TIMING ADJ	5	1 μ s	1 μ s	8C11	—	6	Range other than above	Set TIME/DIV	—	—
Sequence	Item			SS-5706				Input signal	Amplitude on CRT screen	Calibrator																																						
		HORIZ DISPLAY	TIME/DIV	Circuit No.	Name																																											
1	A sweep	A	0.1 ms	0.1 ms	about 4 div	11R19	NORM GAIN																																									
2			1 μ s	1 μ s		7C09	—																																									
3			Range other than above	Set TIME/DIV		—	—																																									
4	B sweep	B (DLY'D)	0.1 ms	0.1 ms		10R18	B TIMING ADJ																																									
5			1 μ s	1 μ s		8C11	—																																									
6			Range other than above	Set TIME/DIV		—	—																																									

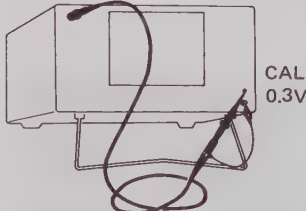
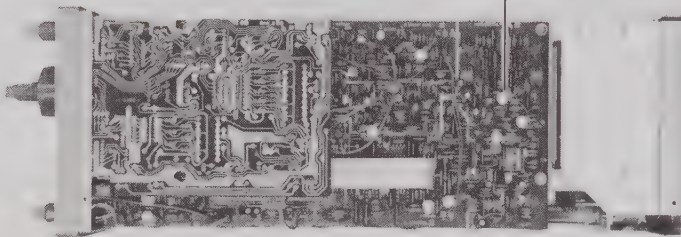
4-11-1 Sweep Rate (cont.)

Item	Description
Check and adjustment	1. Synchronize and set the first pulse to the first division from the left edge of the scale. 2. Set A TIME/DIV and PG REPETITION to 0.1 ms and check the difference between I and II. If the difference in sweep time is great in the same direction, adjust with 11R19 NORM GAIN. 3. Set A TIME/DIV and REPETITION to 1 μs and check the difference between I and II. If the difference is great, adjust with 7C09. 4. Set A TIME/DIV and REPETITION to other range and check. 5. Set HORIZ DISPLAY to B (DYL'D), A TIME/DIV to 0.2 ms, B TIME/DIV to 0.1 ms, REPETITION to 0.1 ms, and check the difference between I and II. 6. If the difference in sweep time is great in the same direction, adjust with 10R18 B TIMING ADJ. 7. Set A TIME/DIV to 2 μs, B TIME/DIV to 1 μs, REPETITION to 1 μs, and check the difference between I and II. If the difference is great, adjust with 8C11. 8. Set A TIME/DIV, B TIME/DIV, and REPETITION to other range and check.
CRT waveform	Sweep time error I  Sweep time error ratio = $\frac{a - b}{a} \times 100 \%$ Sweep time error ratio = where a: effective horizontal surface total scale length (8 div) b: measured value of time marker corresponding to "a". Sweep time error II  Sweep time error ratio = $\frac{a - b}{a} \times 100 \%$ Sweep time error ratio = where a: any 2 div in effective horizontal surface b: measured value of time marker corresponding to "a".

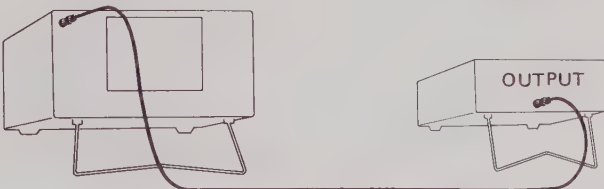
4-11-1 Sweep Rate (cont.)

Item	Description
Adjustment location	 10R18 B TIMING ADJ 8C11 1μs ADJ 11R19 NORM GAIN 7C09 1μs ADJ

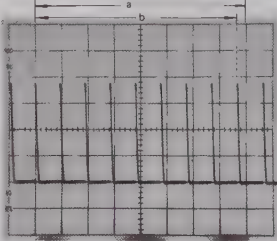
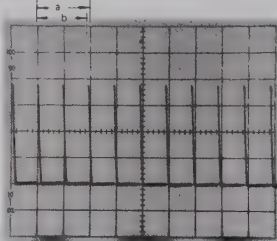
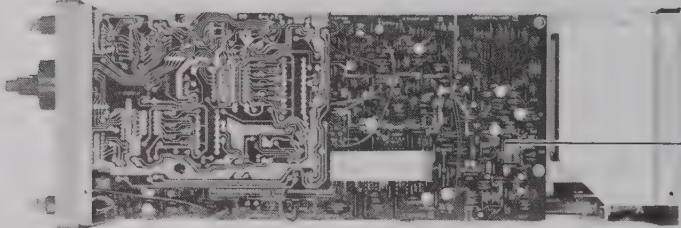
4-11-2 Magnification Center

Item	Description																		
Connection	SS-5706 CH1 INPUT  CAL 0.3V																		
Setting	<table><tr><th>SS-5706</th><th>Input signal</th><th>Amplitude on CRT screen</th><th colspan="2">Adjustment location</th><th>Remarks</th></tr><tr><th>Channel</th><th>CAL output</th><th></th><th>Circuit No.</th><th>Name</th><th></th></tr><tr><td>CH1</td><td>0.3V</td><td>6 div</td><td>11R37</td><td>MAG CENTER</td><td>Use probe</td></tr></table>	SS-5706	Input signal	Amplitude on CRT screen	Adjustment location		Remarks	Channel	CAL output		Circuit No.	Name		CH1	0.3V	6 div	11R37	MAG CENTER	Use probe
SS-5706	Input signal	Amplitude on CRT screen	Adjustment location		Remarks														
Channel	CAL output		Circuit No.	Name															
CH1	0.3V	6 div	11R37	MAG CENTER	Use probe														
Check and adjustment	With the horizontal POSITION, set the sweep start point (rise of CAL waveform) to the center line of scale, pull FINE (PULL x 5 MAG), and check the motion of the sweep start point. If the motion width is great, adjust it with 11R37MAG CENTER.																		
Adjustment location	 11R37 MAG CENT																		

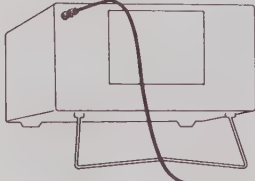
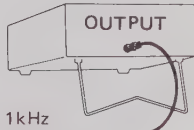
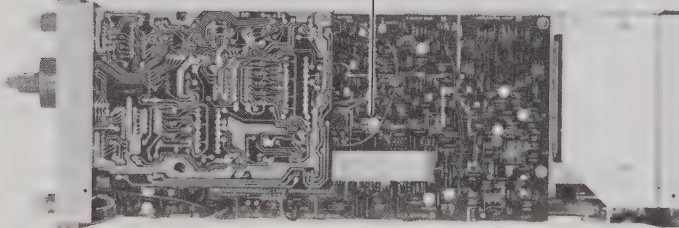
4-11-3 Magnified Sweep Rate

Item	Description																												
Rating	I. At the screen center 8 div: $\pm 5\%$ II. At any 2 div within 8 div from the screen center: $\pm 6\%$ (within $0.1\mu\text{s}$, $0.2\mu\text{s}$ and $0.5\mu\text{s}$ range)																												
Connection	SS-5706 CH1 INPUT  SG (SC-340) OUTPUT Coaxial Cable																												
Setting	<table><tr><th rowspan="2">Sequence</th><th colspan="2">SS-5706</th><th rowspan="2">Input signal</th><th rowspan="2">Amplitude on CRT screen</th><th colspan="2">Calibrator</th></tr><tr><th>HORIZ DISPLAY</th><th>TIME/DIV</th><th>Circuit No.</th><th>Name</th></tr><tr><td>1</td><td rowspan="3">A</td><td>0.1 mS</td><td>$10\mu\text{s}$</td><td rowspan="3">about 4 div</td><td>11R15</td><td>MAG GAIN</td></tr><tr><td>2</td><td>$0.1\mu\text{s}$</td><td>$10\mu\text{s}$</td><td>11R31, 11C14</td><td>—</td></tr><tr><td>3</td><td>Range other than above</td><td>Set to TIME/DIV</td><td>—</td><td>—</td></tr></table>	Sequence	SS-5706		Input signal	Amplitude on CRT screen	Calibrator		HORIZ DISPLAY	TIME/DIV	Circuit No.	Name	1	A	0.1 mS	$10\mu\text{s}$	about 4 div	11R15	MAG GAIN	2	$0.1\mu\text{s}$	$10\mu\text{s}$	11R31, 11C14	—	3	Range other than above	Set to TIME/DIV	—	—
Sequence	SS-5706		Input signal	Amplitude on CRT screen			Calibrator																						
	HORIZ DISPLAY	TIME/DIV			Circuit No.	Name																							
1	A	0.1 mS	$10\mu\text{s}$	about 4 div	11R15	MAG GAIN																							
2		$0.1\mu\text{s}$	$10\mu\text{s}$		11R31, 11C14	—																							
3		Range other than above	Set to TIME/DIV		—	—																							
Check and adjustment	1. Pull FINE (PULL $\times 5$ MG) and check the difference between rating I and II. 2. If the difference is great in the same direction, adjust with 11R15 MAG GAIN. 3. If the difference in $0.1\mu\text{s}$ range is great, adjust with 11R31 and 11C14. 4. Set A TIME/DIV and REPETITION to other range and check.																												

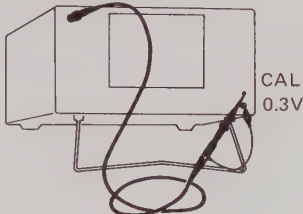
4-11-3 Magnified Sweep Rate (cont.)

Item	Description
CRT waveform	Sweep time error I  Sweep time error ratio = $\frac{a-b}{a} \times 100$ (%) Sweep time error ratio = where a: effective horizontal surface total scale length (8 div) b: measured value of time marker corresponding to "a". Sweep time error II  Sweep time error ratio = $\frac{a-b}{a} \times 100$ (%) Sweep time error ratio = where a: any 2 div in effective horizontal surface b: measured value of time marker corresponding to "a".
Adjustment location	 11R15 MAG GAIN

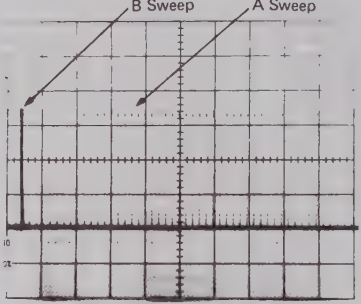
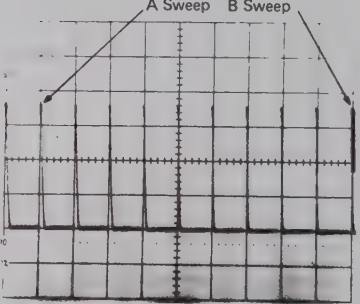
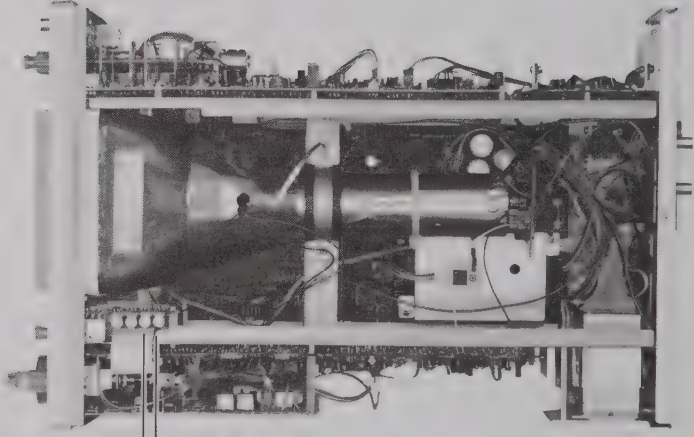
4-11-4 A Sweep Trace Length

Item	Description																
Rating	10.5 div to 13 div (at 1 ms/div)																
Connection	SS-5706 CH1 INPUT  SG (SC-340) OUTPUT  1 kHz																
Setting	<table><tr><th rowspan="2">Item</th><th colspan="2">SS-5706</th><th rowspan="2">Input signal Repetition rate</th><th colspan="2">Adjustment location</th></tr><tr><th>HORIZ DISPLAY</th><th>A TIME/DIV</th><th>Circuit No.</th><th>Name</th></tr><tr><td>A sweep</td><td>A</td><td>1 mS</td><td>1 mS</td><td>7R25</td><td>A LENGTH</td></tr></table>	Item	SS-5706		Input signal Repetition rate	Adjustment location		HORIZ DISPLAY	A TIME/DIV	Circuit No.	Name	A sweep	A	1 mS	1 mS	7R25	A LENGTH
Item	SS-5706		Input signal Repetition rate	Adjustment location													
	HORIZ DISPLAY	A TIME/DIV		Circuit No.	Name												
A sweep	A	1 mS	1 mS	7R25	A LENGTH												
Check and adjustment	Check that a trace contains 10.5 to 13 pulses. If the error is great in A sweep, adjust 7R25 A LENGTH.																
Adjustment location	 7R25 A LENGTH																

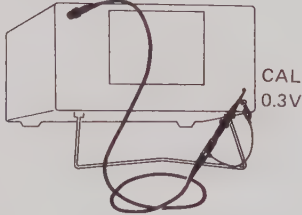
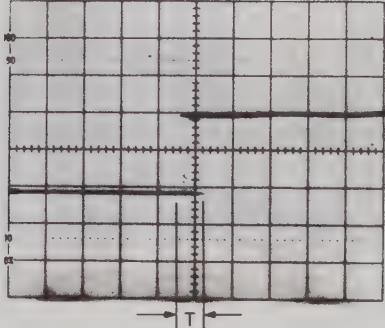
4-11-5 Start and Stop of Delay

Item	Description																							
Connection	SS-5706 CH1 INPUT  CAL 0.3V																							
Setting and calibrator	<table><tr><th rowspan="2">Sequence</th><th colspan="2">SS-5706</th><th rowspan="2">A TIME/ DIV</th><th rowspan="2">B TIME/ DIV</th><th rowspan="2">Input signal Repetition rate</th><th colspan="2">Calibrator</th></tr><tr><th>HORIS DISPLAY</th><th>MODE (horizontal)</th><th>Circuit No.</th><th>Name</th></tr><tr><td>1</td><td rowspan="2">A INTEN</td><td rowspan="2">RUNS AFTER DELAY</td><td rowspan="2">1 ms</td><td rowspan="2">5 μs</td><td rowspan="2">2 μs</td><td>6R15</td><td>START ADJ</td></tr><tr><td>2</td><td>6R13</td><td>STOP ADJ</td></tr></table>	Sequence	SS-5706		A TIME/ DIV	B TIME/ DIV	Input signal Repetition rate	Calibrator		HORIS DISPLAY	MODE (horizontal)	Circuit No.	Name	1	A INTEN	RUNS AFTER DELAY	1 ms	5 μ s	2 μ s	6R15	START ADJ	2	6R13	STOP ADJ
Sequence	SS-5706		A TIME/ DIV	B TIME/ DIV				Input signal Repetition rate	Calibrator															
	HORIS DISPLAY	MODE (horizontal)			Circuit No.	Name																		
1	A INTEN	RUNS AFTER DELAY	1 ms	5 μ s	2 μ s	6R15	START ADJ																	
2						6R13	STOP ADJ																	
Check and adjustment	1. Set $\leftrightarrow$ POSITION so that A-sweep start point is at the leftmost vertical scale. 2. Check that B-sweep start point is 0.5 div from the leftmost vertical scale when DELAY TIME is turned all the way counter clockwise. 3. If the difference is great, adjust with 6R15 START ADJ. 4. Check that B-sweep start point is 10.5 div from the leftmost vertical scale when DELAY TIME is turned all the way clockwise. 5. If the difference is great, adjust with 6R13 STOP ADJ. PRECAUTION Setps 3 and 5 affect one another, so make adjustment repeatedly.																							

4-11-5 Start and Stop of Delay (cont.)

Item	Description
CRT waveform	 A TIME/DIV 1 mS, B TIME/DIV 5 μS Input signal: 0.2 mS pulse wave  A TIME/DIV 1 mS, B TIME/DIV 5 μS Input signal: 1 mS pulse wave
Adjustment location	 6R13 STOP ADJ 6R15 START ADJ

4-11-6 Jitter

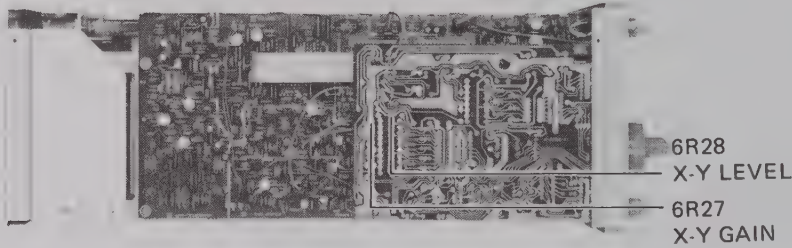
Item	Description																				
Rating	1/20,000 or less																				
Connection	SS-5706 CH1 INPUT  CAL 0.3V																				
Setting and adjustment location	<table><tr><th colspan="4">SS-5706</th><th colspan="2">Input signal</th><th rowspan="2">Amplitude on CRT screen</th></tr><tr><th>HORIZ DISPLAY</th><th>MODE (sweep)</th><th>A TIME/DIV</th><th>B TIME/DIV</th><th>Waveform</th><th>Repetition rate</th></tr><tr><td>B</td><td>RUNS AFTER DELAY</td><td>0.2 mS</td><td>0.1 μs</td><td>Time marker</td><td>0.2 mS</td><td>2 div</td></tr></table>	SS-5706				Input signal		Amplitude on CRT screen	HORIZ DISPLAY	MODE (sweep)	A TIME/DIV	B TIME/DIV	Waveform	Repetition rate	B	RUNS AFTER DELAY	0.2 mS	0.1 μ s	Time marker	0.2 mS	2 div
SS-5706				Input signal		Amplitude on CRT screen															
HORIZ DISPLAY	MODE (sweep)	A TIME/DIV	B TIME/DIV	Waveform	Repetition rate																
B	RUNS AFTER DELAY	0.2 mS	0.1 μ s	Time marker	0.2 mS	2 div															
Check	Set DELAY TIME so that the 11th time marker can be observed and check that jitter is 1 div or less.																				
CRT waveform	 T = 1 div or less																				

4-12 X-Y OPERATION INSPECTION AND CALIBRATION

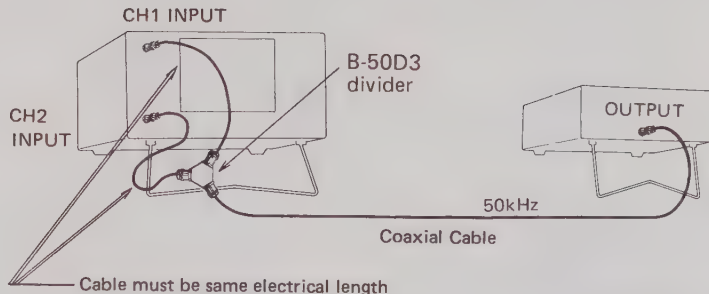
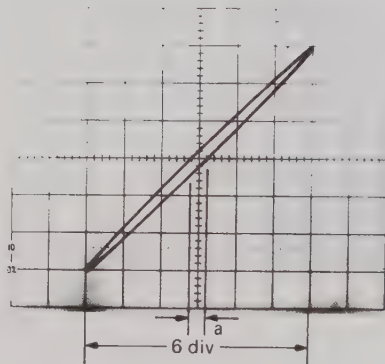
4-12-1 Deflection Factor and Intensity Level

Item	Description																																
Rating	X-axis (same as CH2 VOLTS/DIV): ± 2% (at x1) Y-axis (same as CH1 VOLTS/DIV): ± 5% (at x1)																																
Connection	SS-5706 CH1 INPUT CH2 INPUT B50D3 divider SG (SC-340) OUTPUT Coaxial Cable																																
Setting and adjustment location	<table><tr><th rowspan="2">Sequence</th><th colspan="3">SS-5706</th><th colspan="3">Input signal</th><th rowspan="2">Amplitude on CRT screen</th><th colspan="2">Calibrator</th></tr><tr><th>Channel</th><th>HORIZ DISPLAY</th><th>GND</th><th>Voltage</th><th>Waveform</th><th>Fre- quency</th><th>Circuit No.</th><th>Name</th></tr><tr><td>1</td><td rowspan="2">CH1</td><td rowspan="2">X-Y</td><td>CH2</td><td rowspan="2">30 mV</td><td rowspan="2">Square wave</td><td rowspan="2">1 kHz</td><td rowspan="2">6 div spot</td><td>6R27</td><td>X-Y GAIN</td></tr><tr><td>2</td><td>CH1, 2</td><td>6R28</td><td>X-Y LEVEL</td></tr></table>	Sequence	SS-5706			Input signal			Amplitude on CRT screen	Calibrator		Channel	HORIZ DISPLAY	GND	Voltage	Waveform	Fre- quency	Circuit No.	Name	1	CH1	X-Y	CH2	30 mV	Square wave	1 kHz	6 div spot	6R27	X-Y GAIN	2	CH1, 2	6R28	X-Y LEVEL
Sequence	SS-5706			Input signal			Amplitude on CRT screen	Calibrator																									
	Channel	HORIZ DISPLAY	GND	Voltage	Waveform	Fre- quency		Circuit No.	Name																								
1	CH1	X-Y	CH2	30 mV	Square wave	1 kHz	6 div spot	6R27	X-Y GAIN																								
2			CH1, 2					6R28	X-Y LEVEL																								
Check and adjustment	1. Switch MODE (vertical) to X-Y and press CH2 GND. Check that horizontal amplitude is 6 div ±5%. If the difference is great, adjust with 6R27 X-Y GAIN. 2. Check that the beam (turn INTEN clockwise if the beam is not present) appears in the center of screen when CH1 is set to GND. If the beam is not close to the center, adjust with 6R28 X-Y LEVEL. REFERENCE ● Repeat items 1 and 2 because they affect each other. ● Do not connect a 50Ω terminator to CH1 OUT during X-Y mode because X-Y gain will be affected.																																

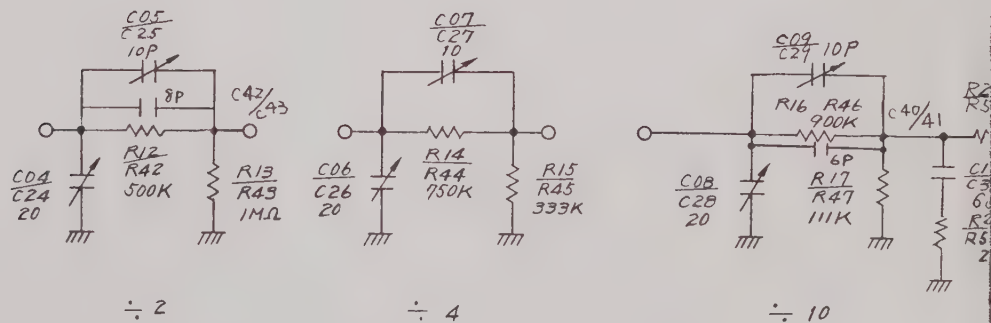
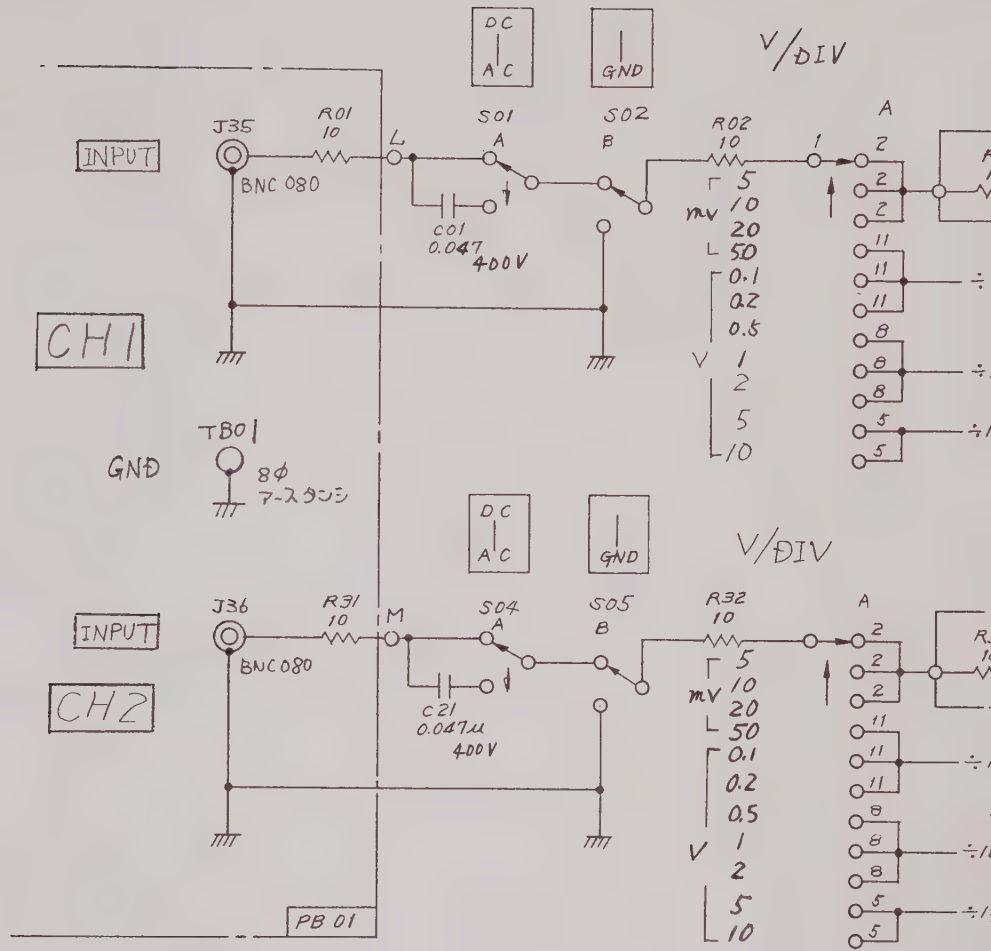
4-12-1 Deflection Factor and Intensity Level (cont.)

Item	Description
Adjustment location	

4-12-2 Phase Difference

Item	Description																
Rating	Within 3° (from DC to 50 kHz sine wave)																
Connection	SS-5706 SG (SC-340)  Cable must be same electrical length																
Setting	<table><tr><th>SS-5706</th><th colspan="3">Input signal</th><th rowspan="2">Aplitude on CRT screen (vertical and horizontal)</th><th rowspan="2">Remarks</th></tr><tr><th>MODE (vertical)</th><th>Voltage</th><th>Waveform</th><th>Frequency</th></tr><tr><td>X-Y</td><td>30 mV</td><td>sine</td><td>50 kHz</td><td>6 div</td><td>Divider B-50D3 used</td></tr></table>	SS-5706	Input signal			Aplitude on CRT screen (vertical and horizontal)	Remarks	MODE (vertical)	Voltage	Waveform	Frequency	X-Y	30 mV	sine	50 kHz	6 div	Divider B-50D3 used
SS-5706	Input signal			Aplitude on CRT screen (vertical and horizontal)	Remarks												
MODE (vertical)	Voltage	Waveform	Frequency														
X-Y	30 mV	sine	50 kHz	6 div	Divider B-50D3 used												
Check	Read "a" on the screen and check the reading is less than 0,3 div.																
CRT waveform	 a : Opening at horizontal center line																

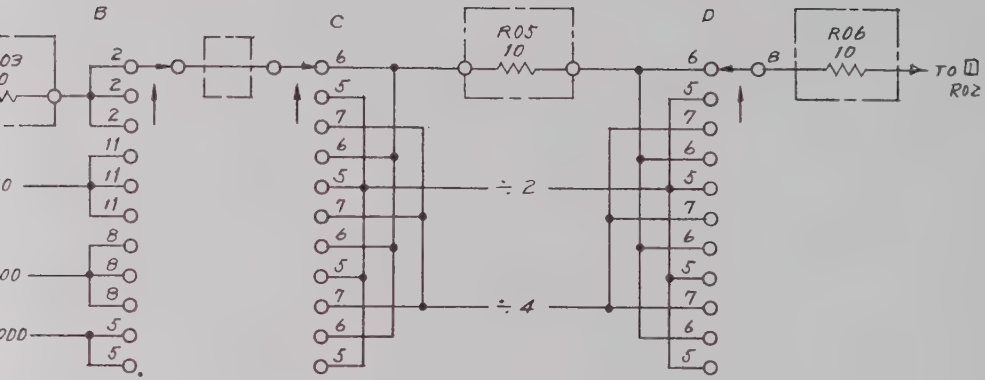
Schematic Diagrams



PB 01

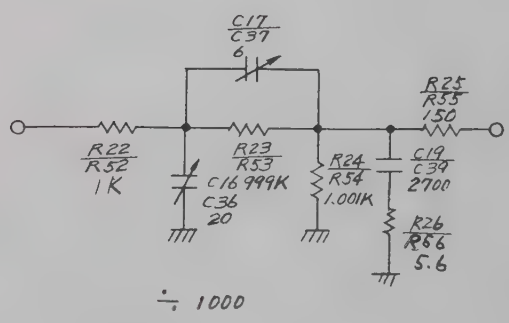
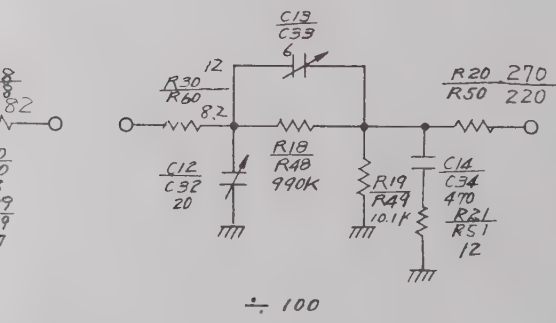
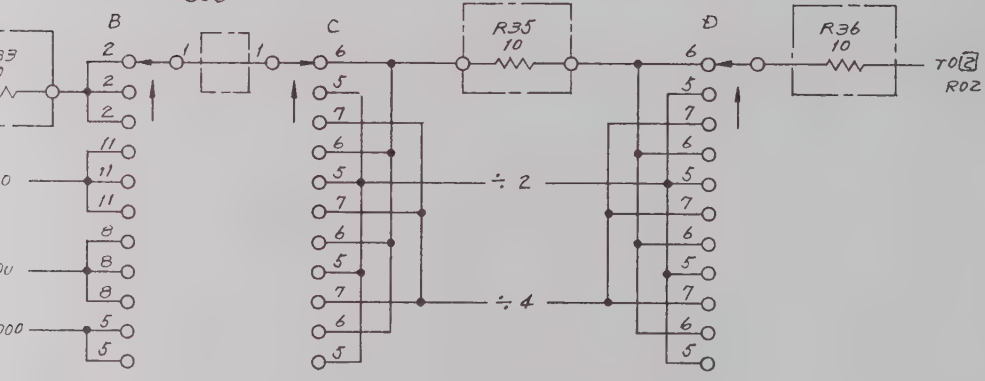
CH1 VOLTS/DIV

S03

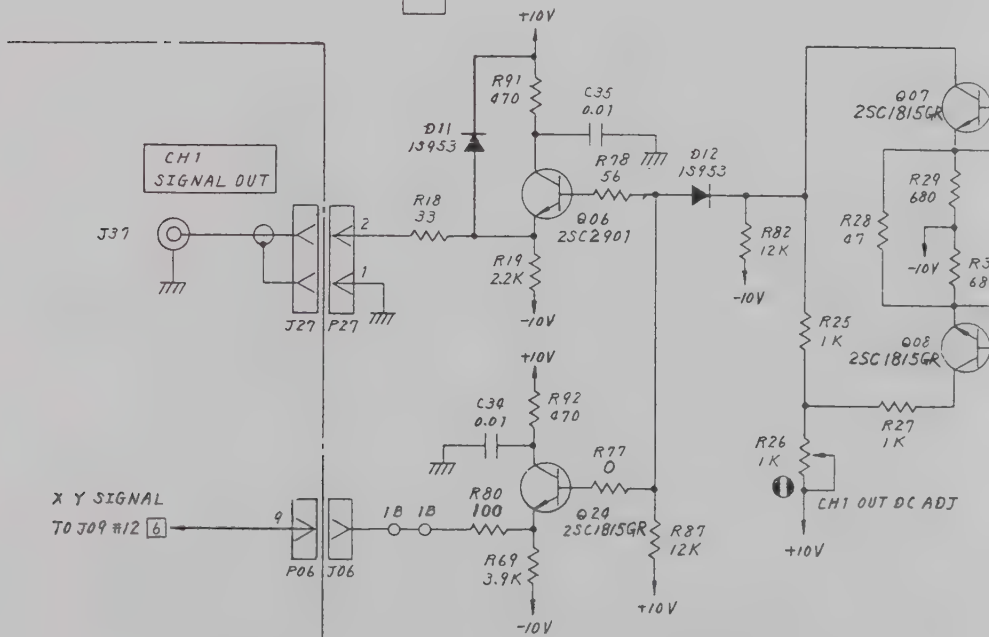
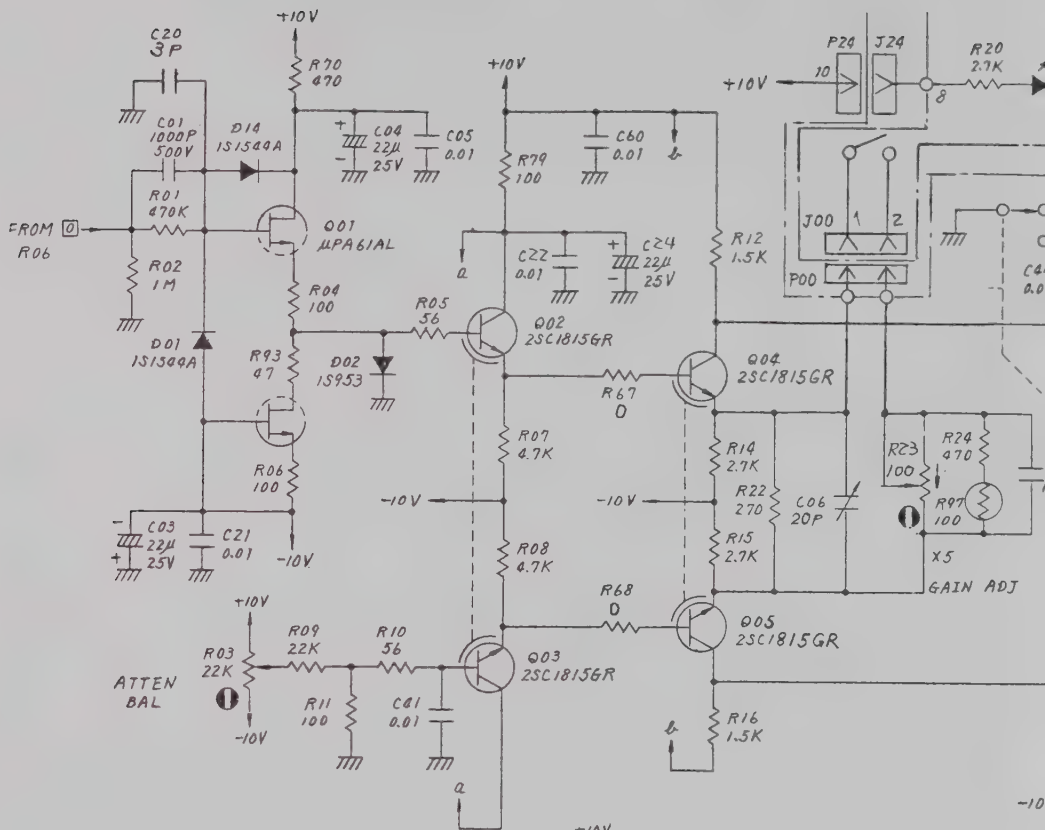


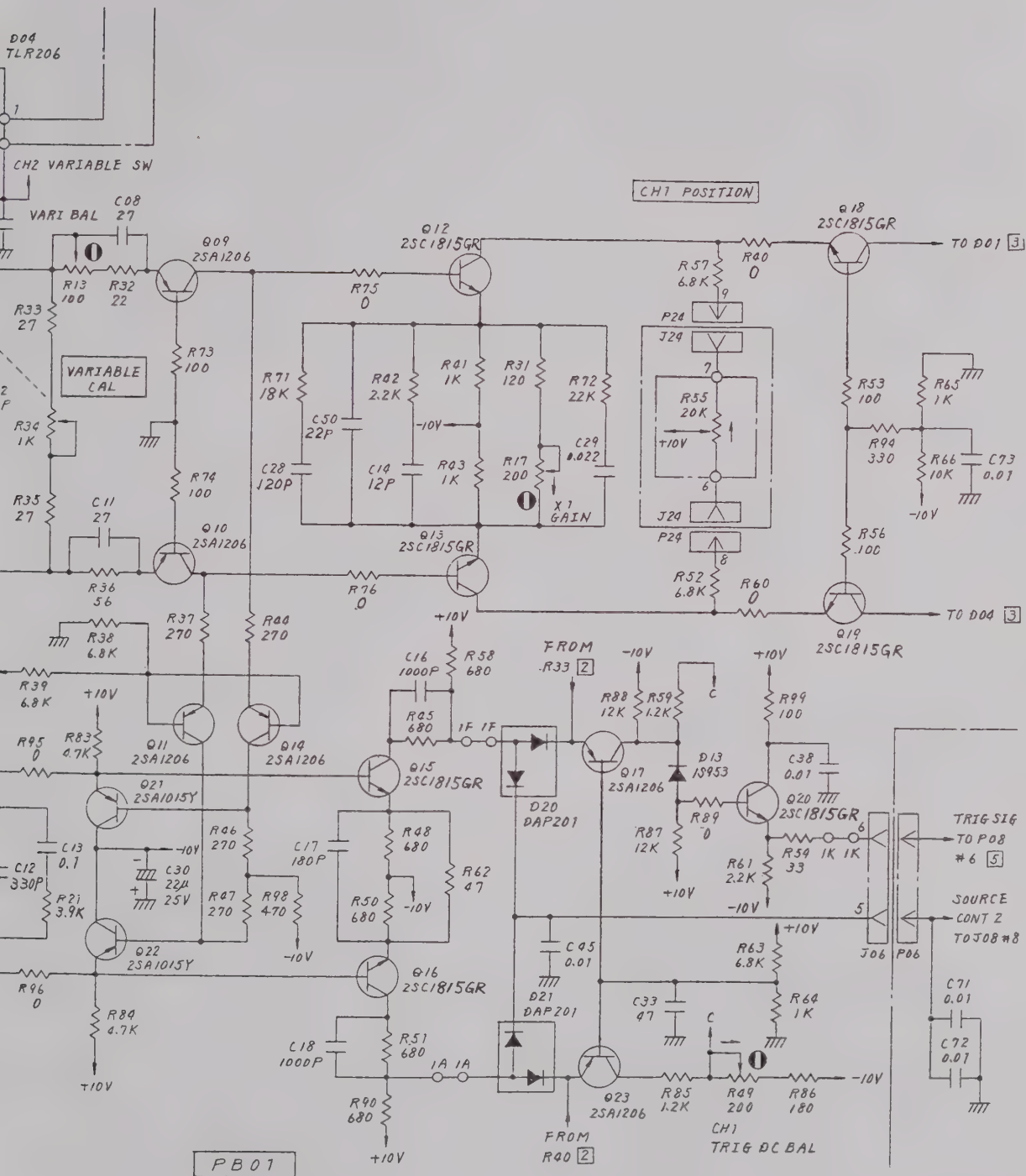
CH2 VOLTS/DIV

S06



名 称 SS-5704/SS-5705/SS-5706		0
ATTENUATOR		
KBBSS24049101		

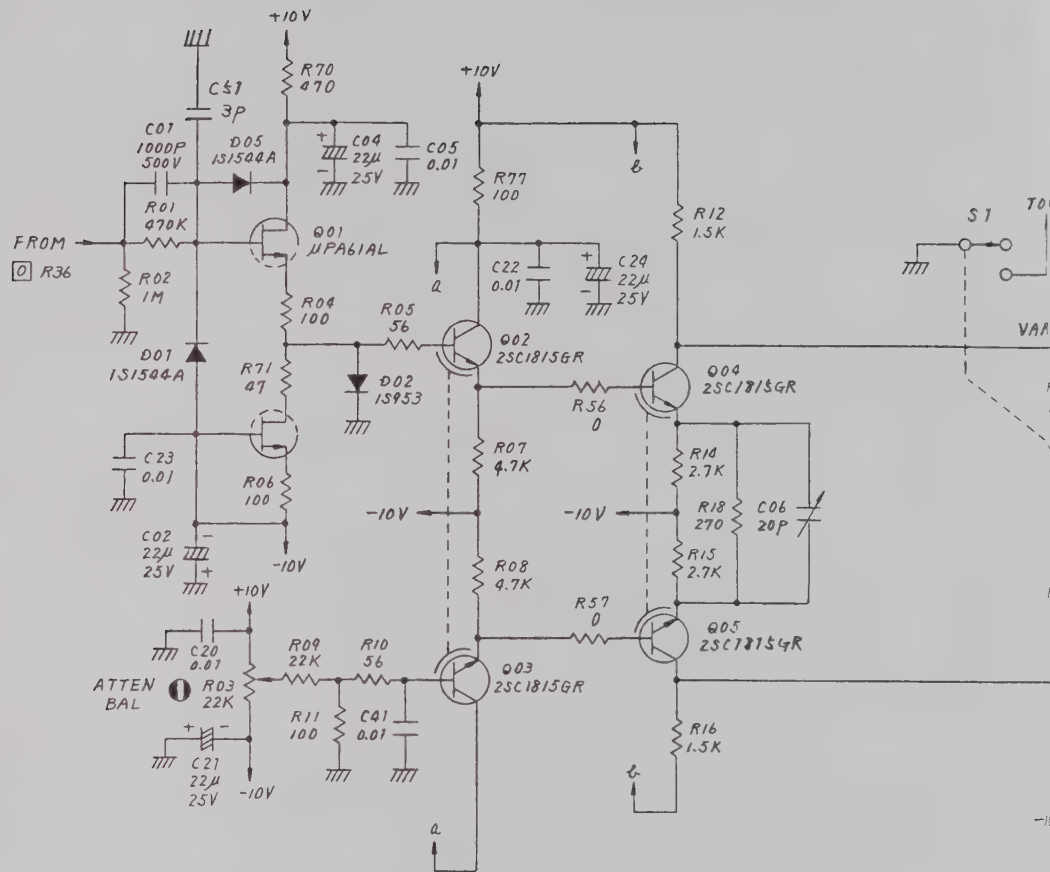


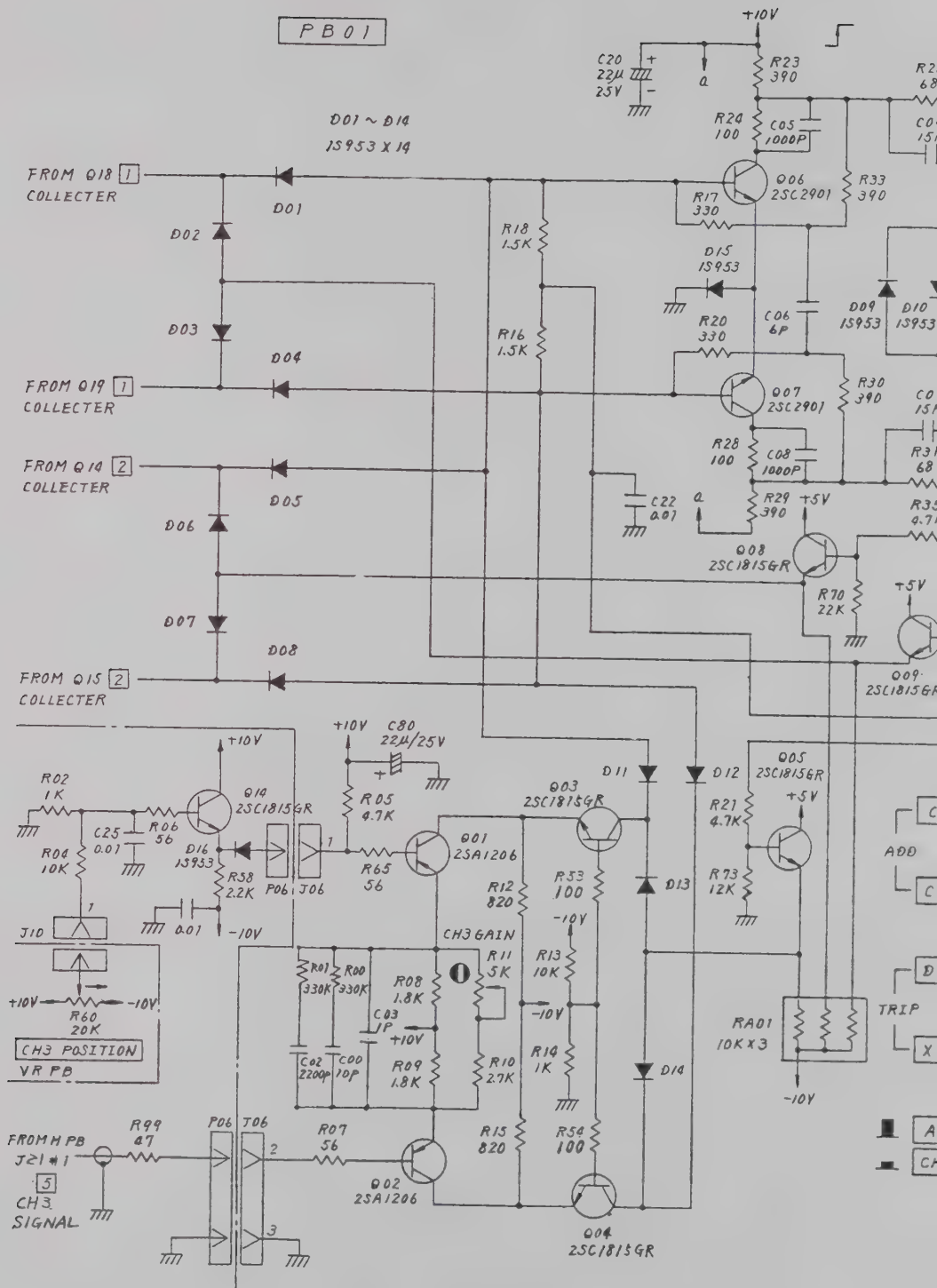


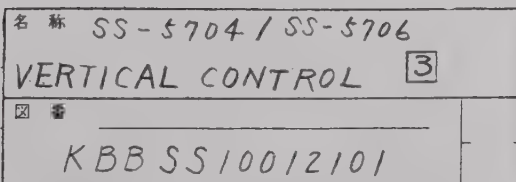
名称 SS-5704/SS-5706
CH1 PREAMPLIFIER 1

图号

KBB SS24054101



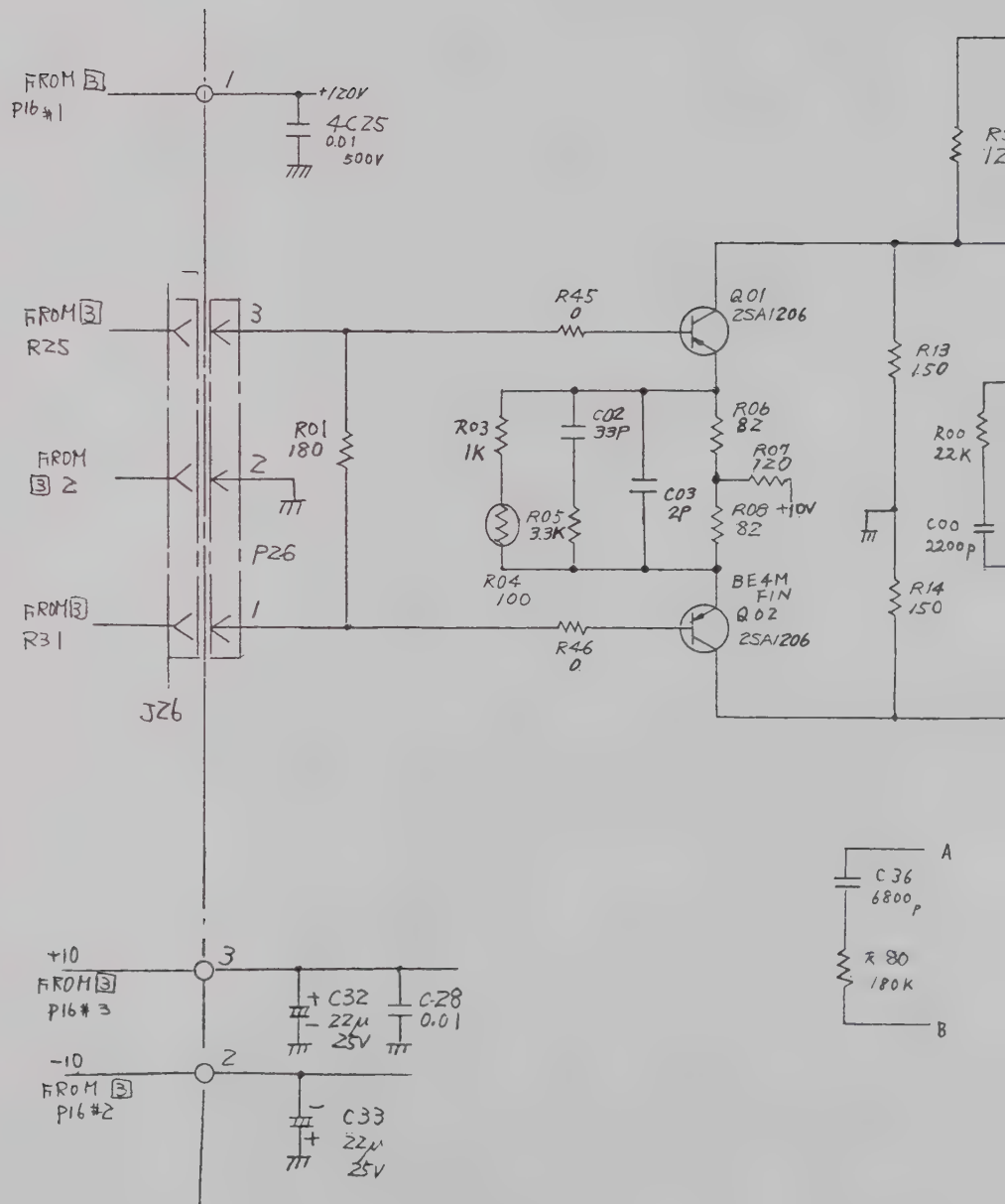




VERTICAL CONTROL 3

100

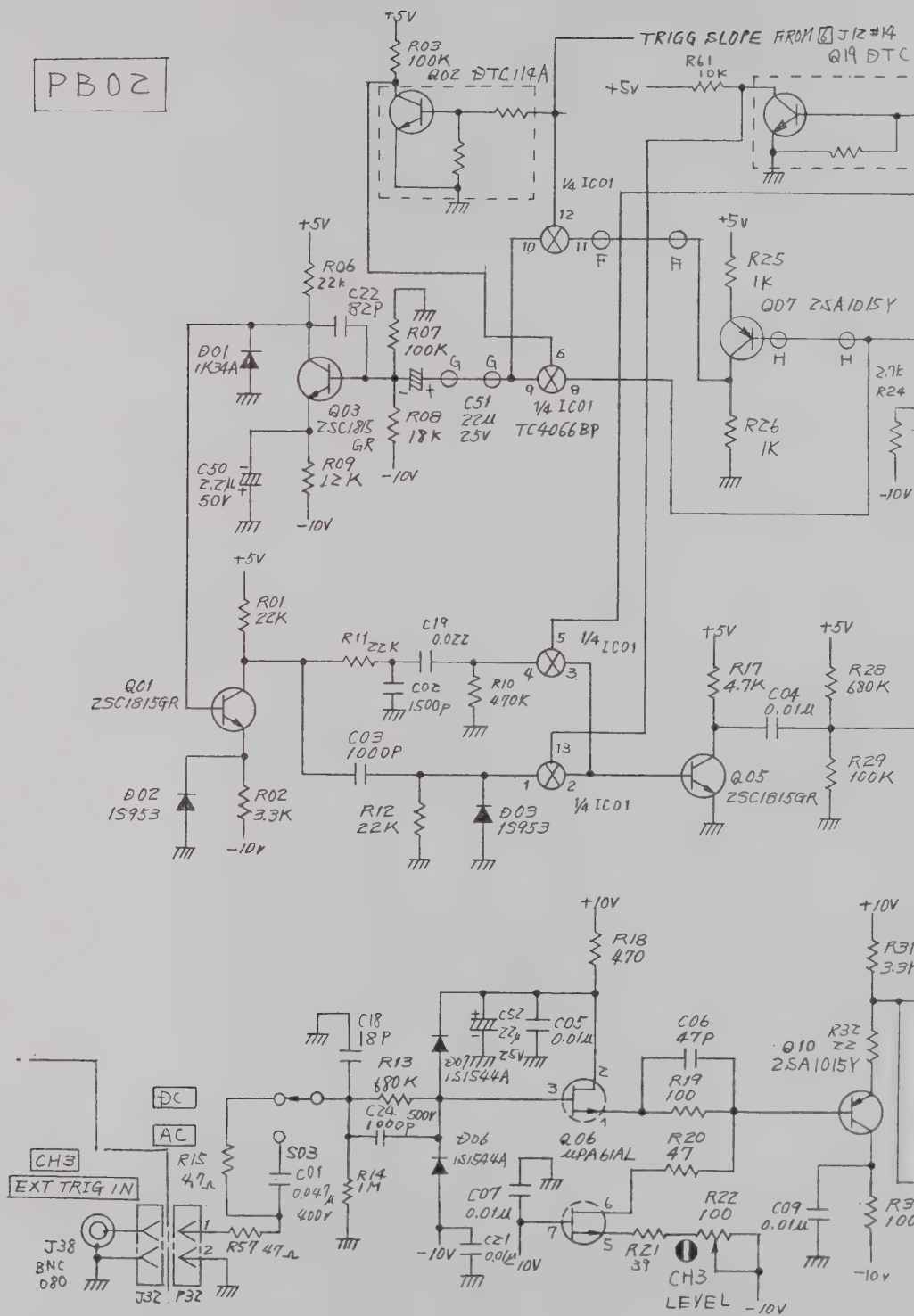
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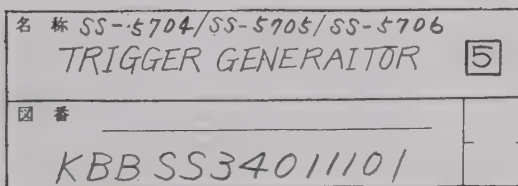


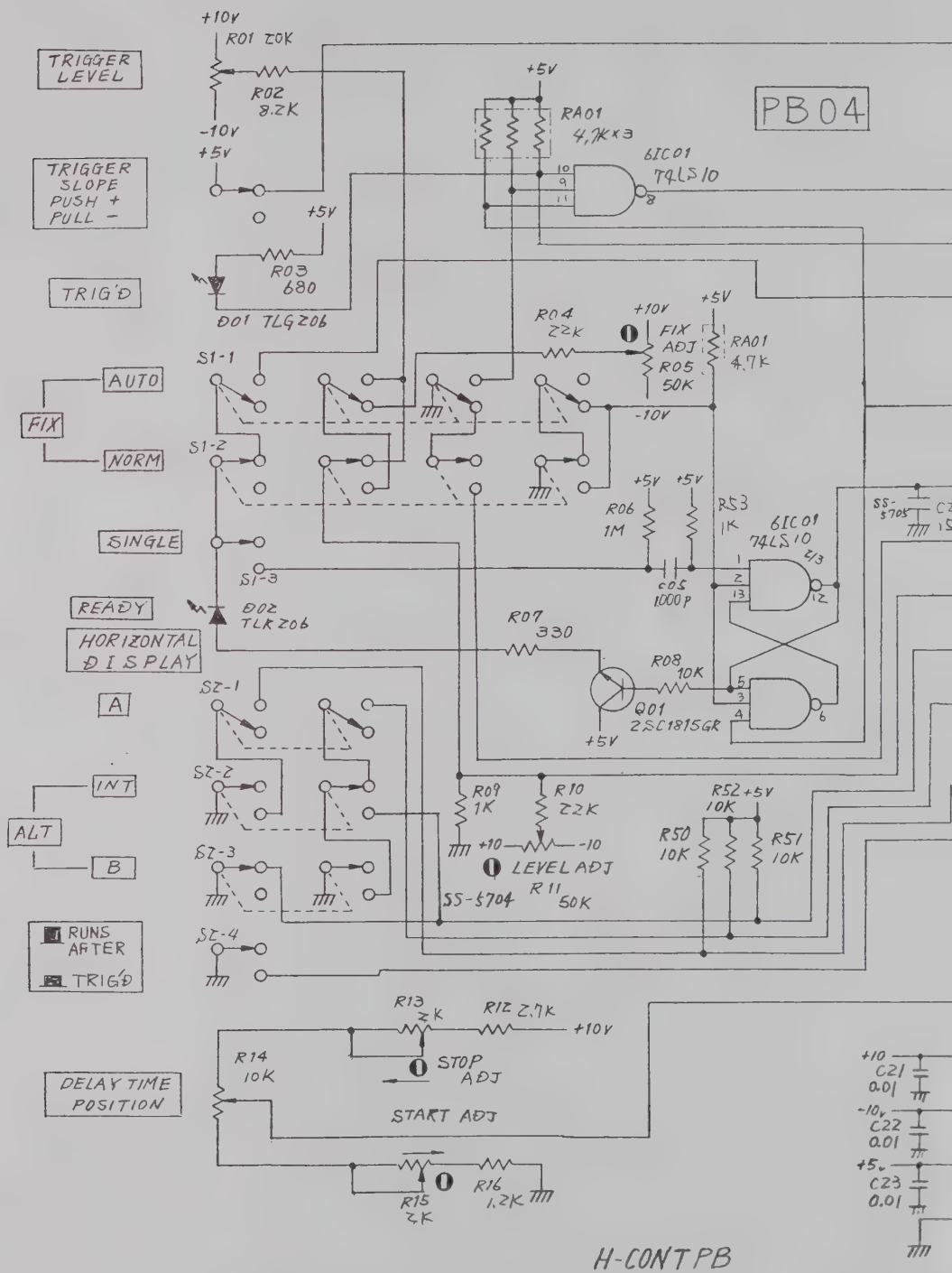


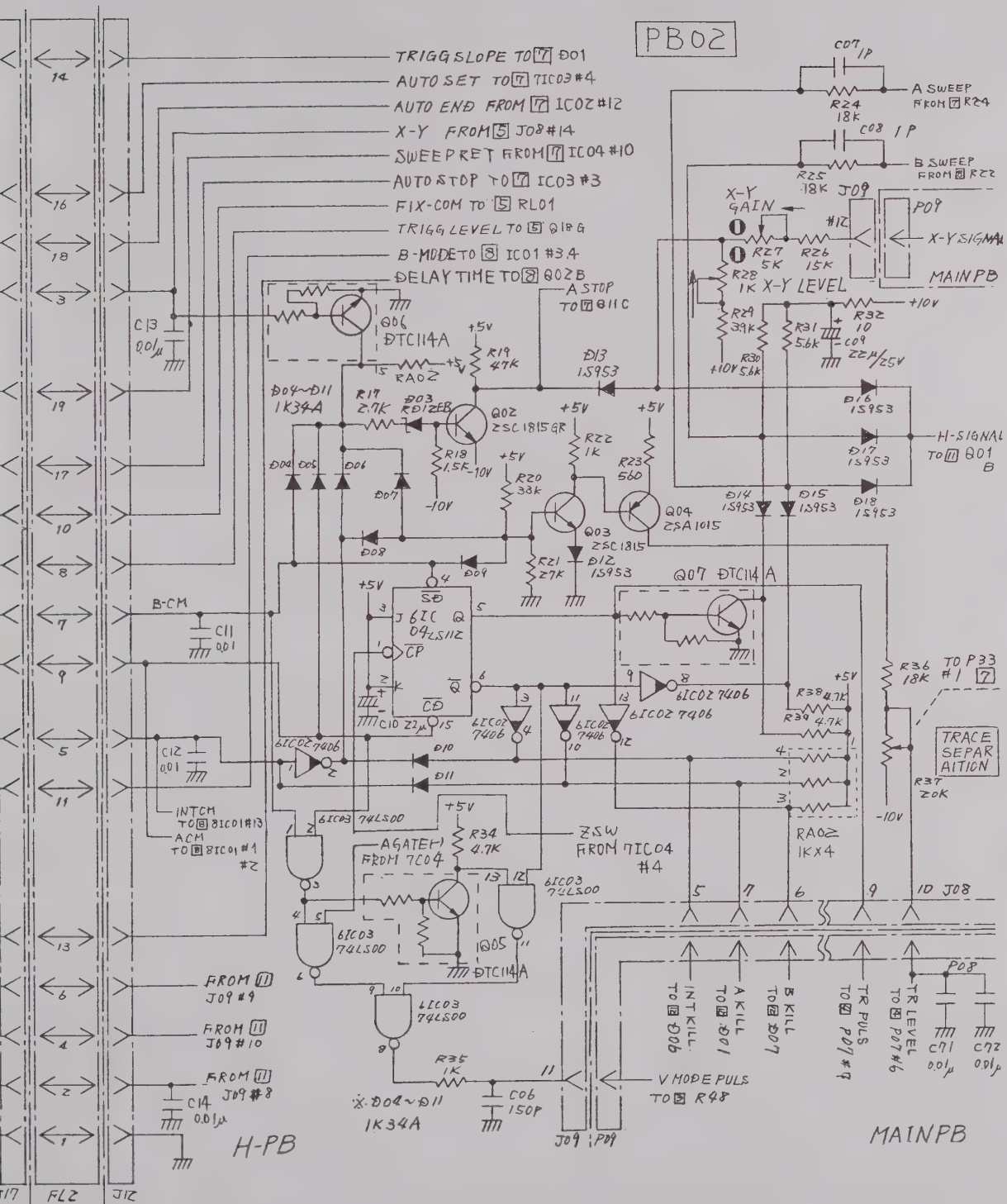
名称 SS-5704 / SS-5706
VERTICAL MAIN AMPLIFIER 4
図番 _____
KBB 5524056101

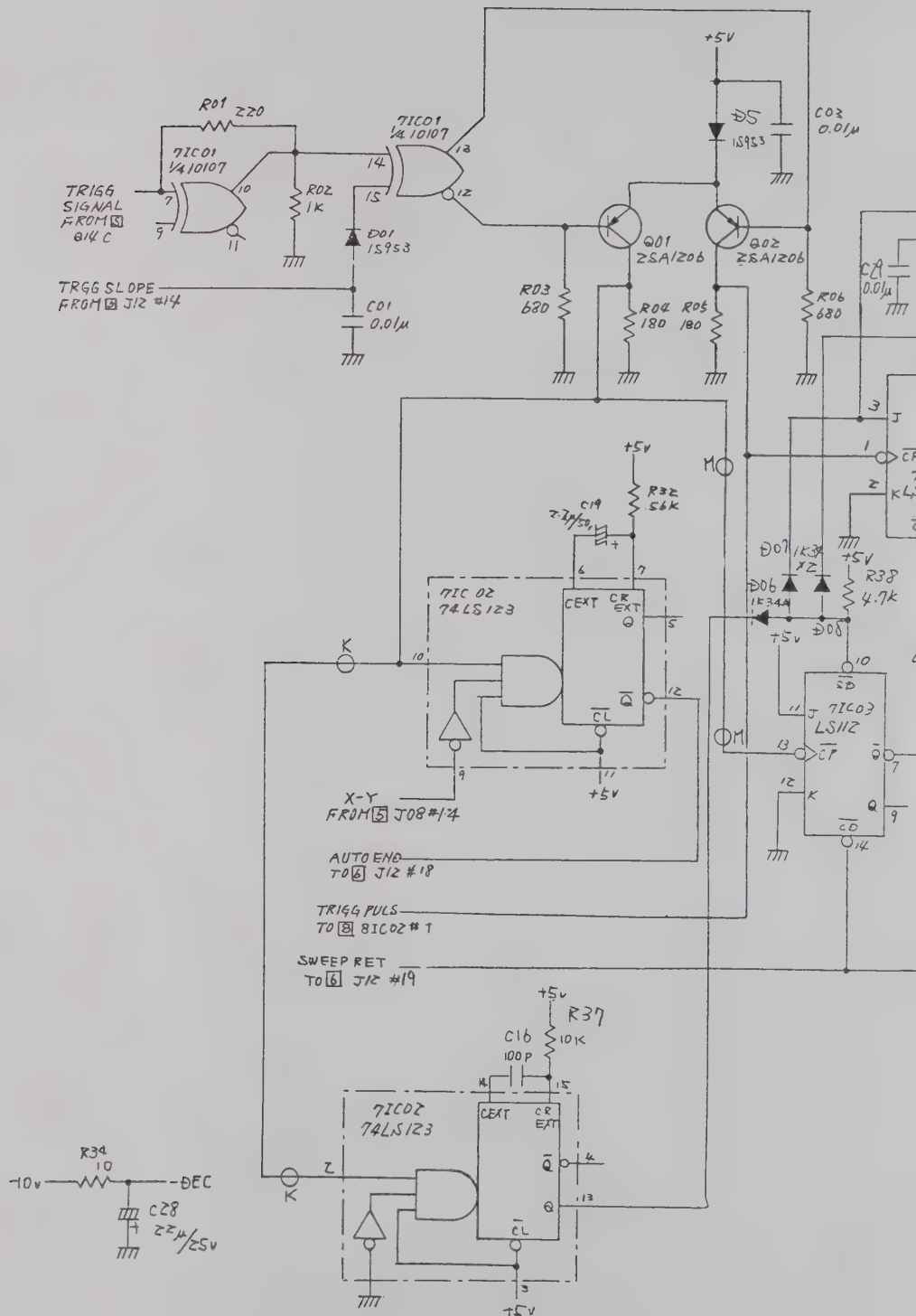
PB02

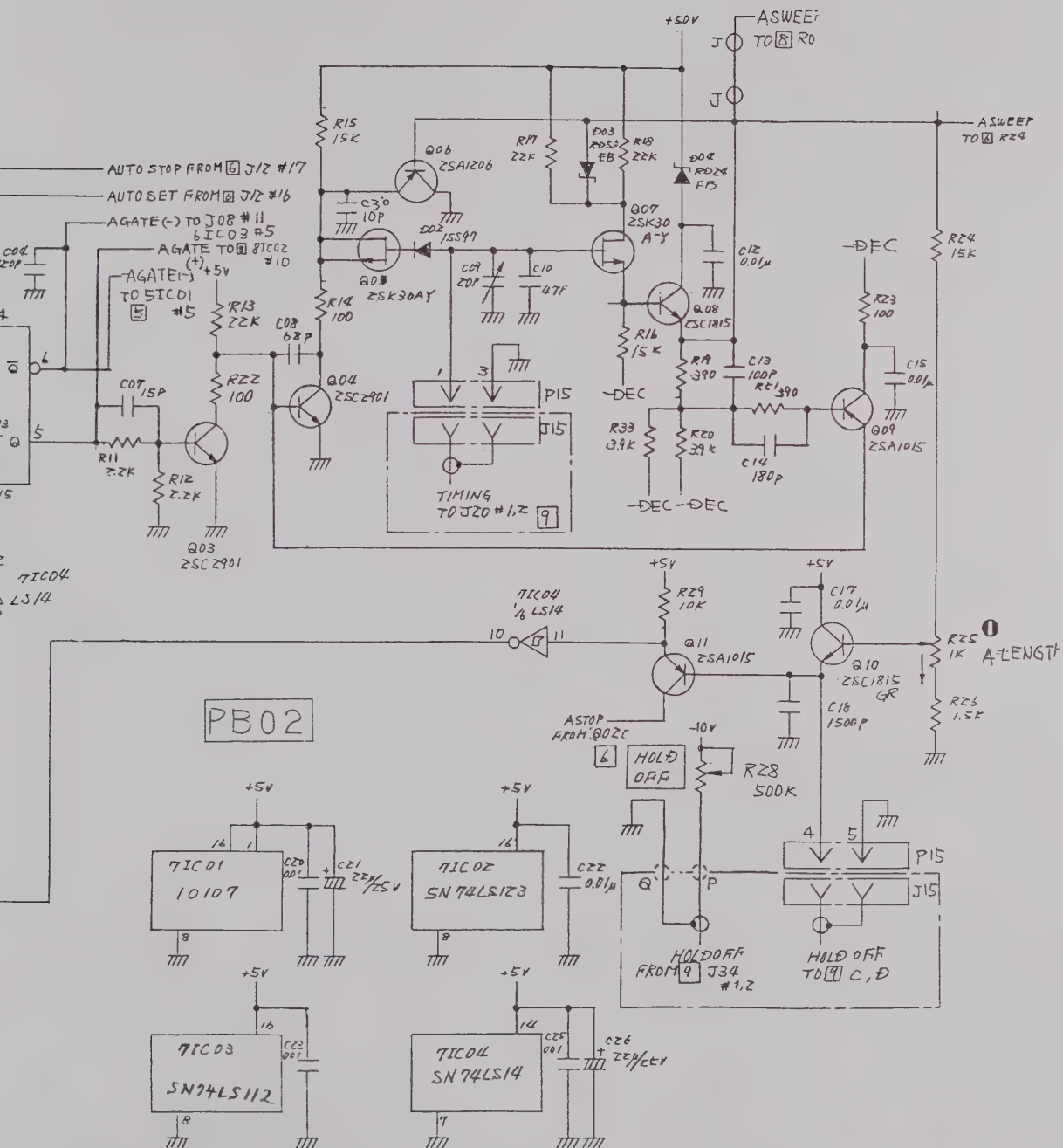




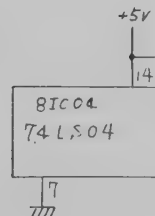
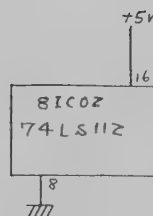
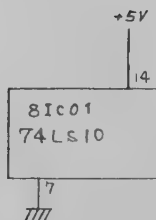
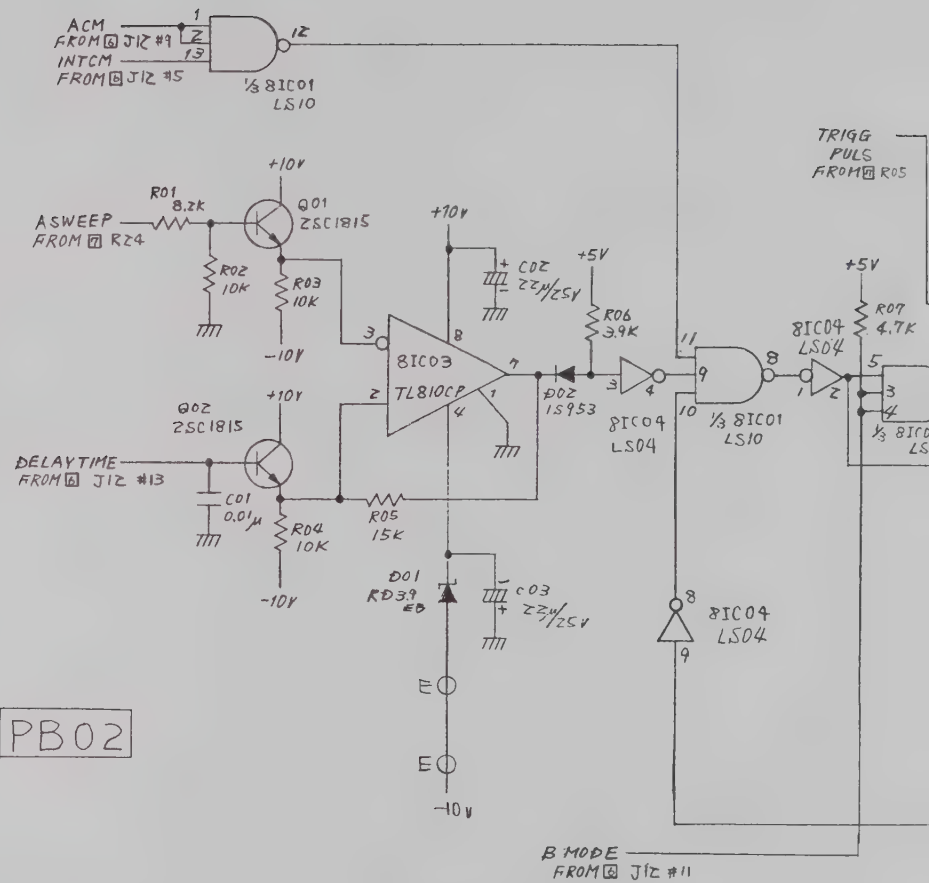


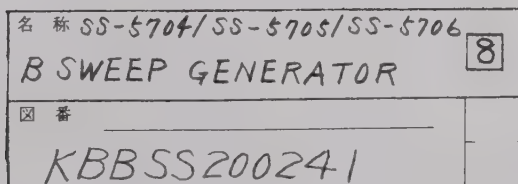




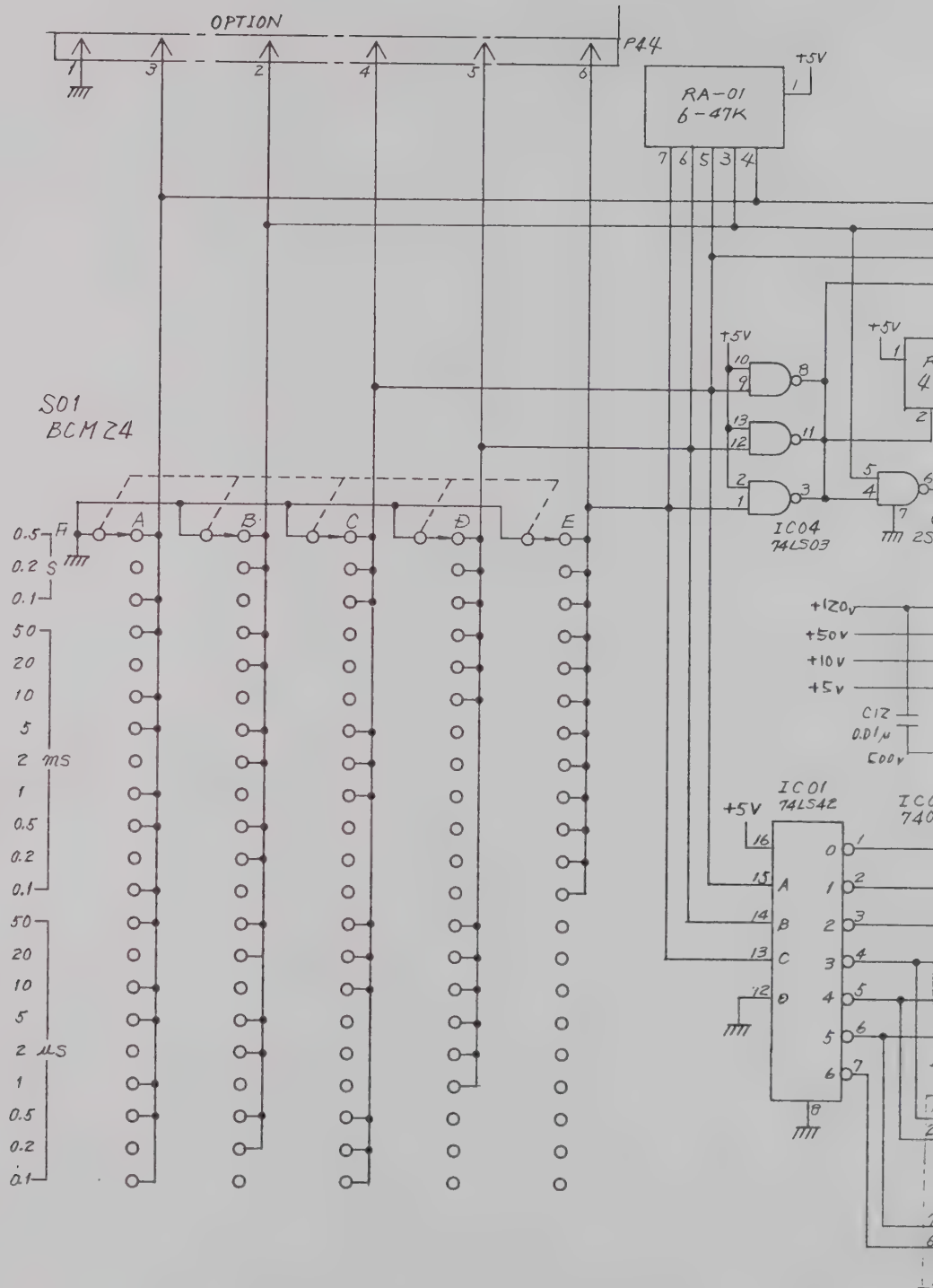


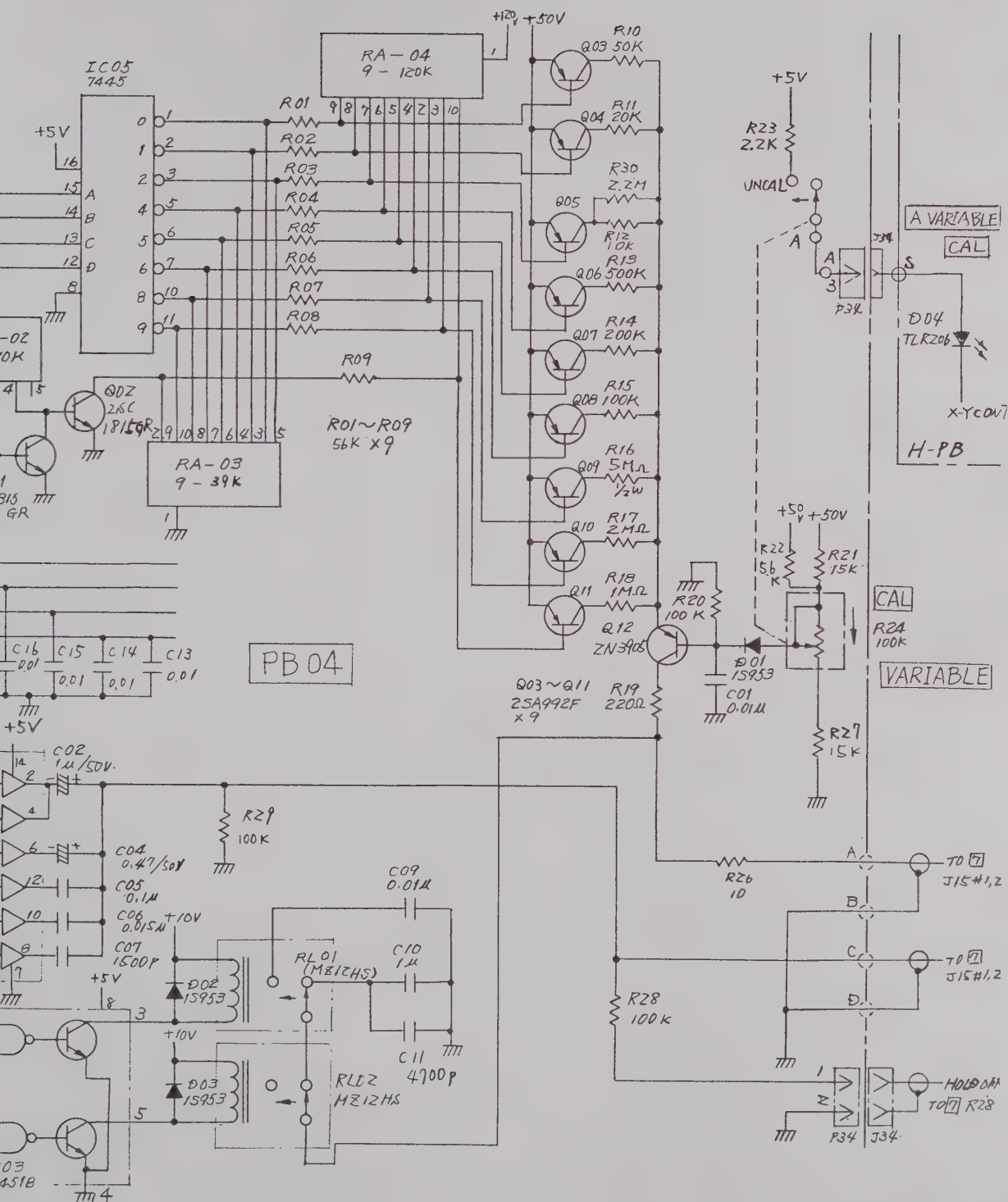
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A SWEEP GENERATOR	
图号	KBB SS 20027/01



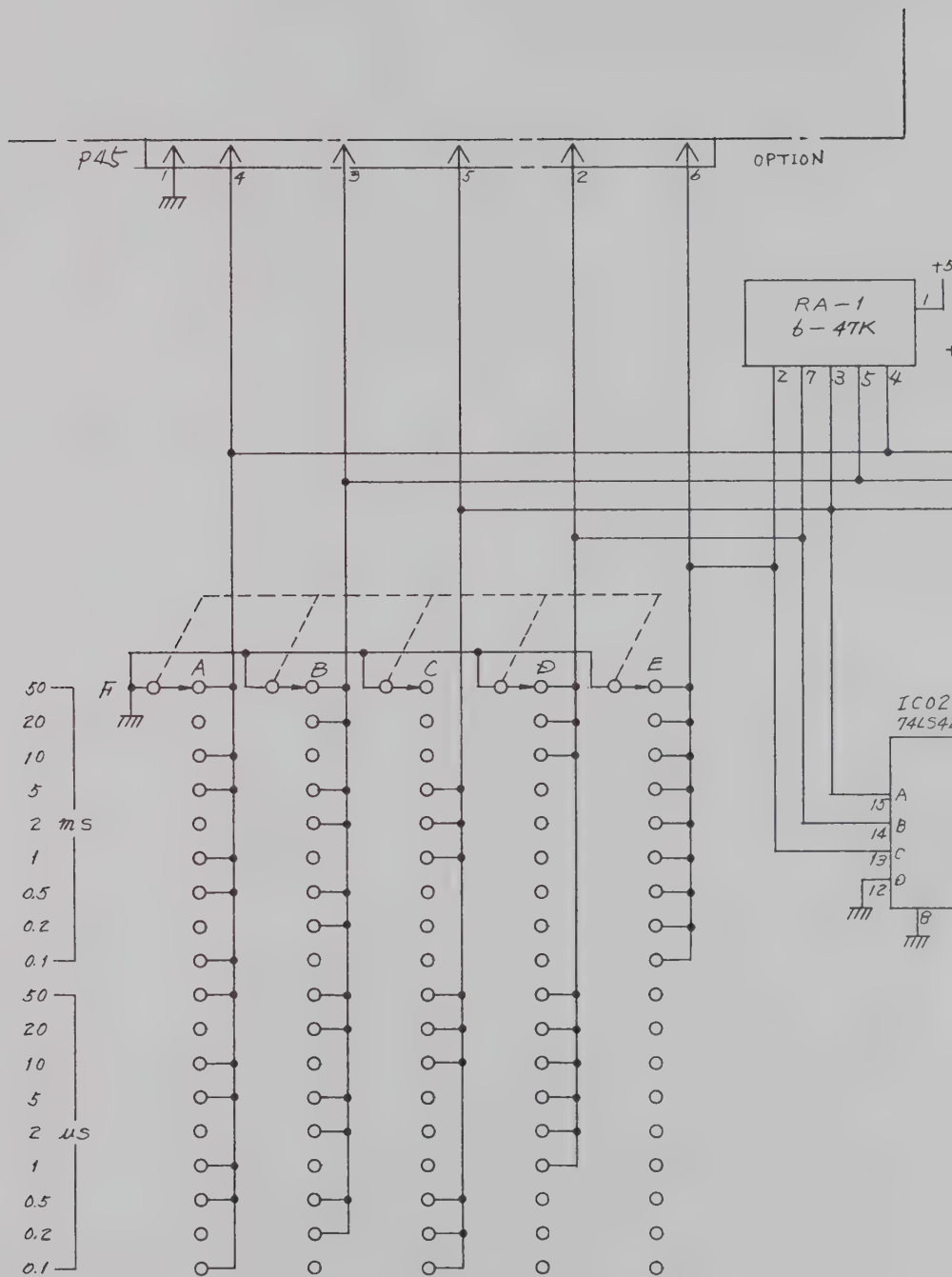


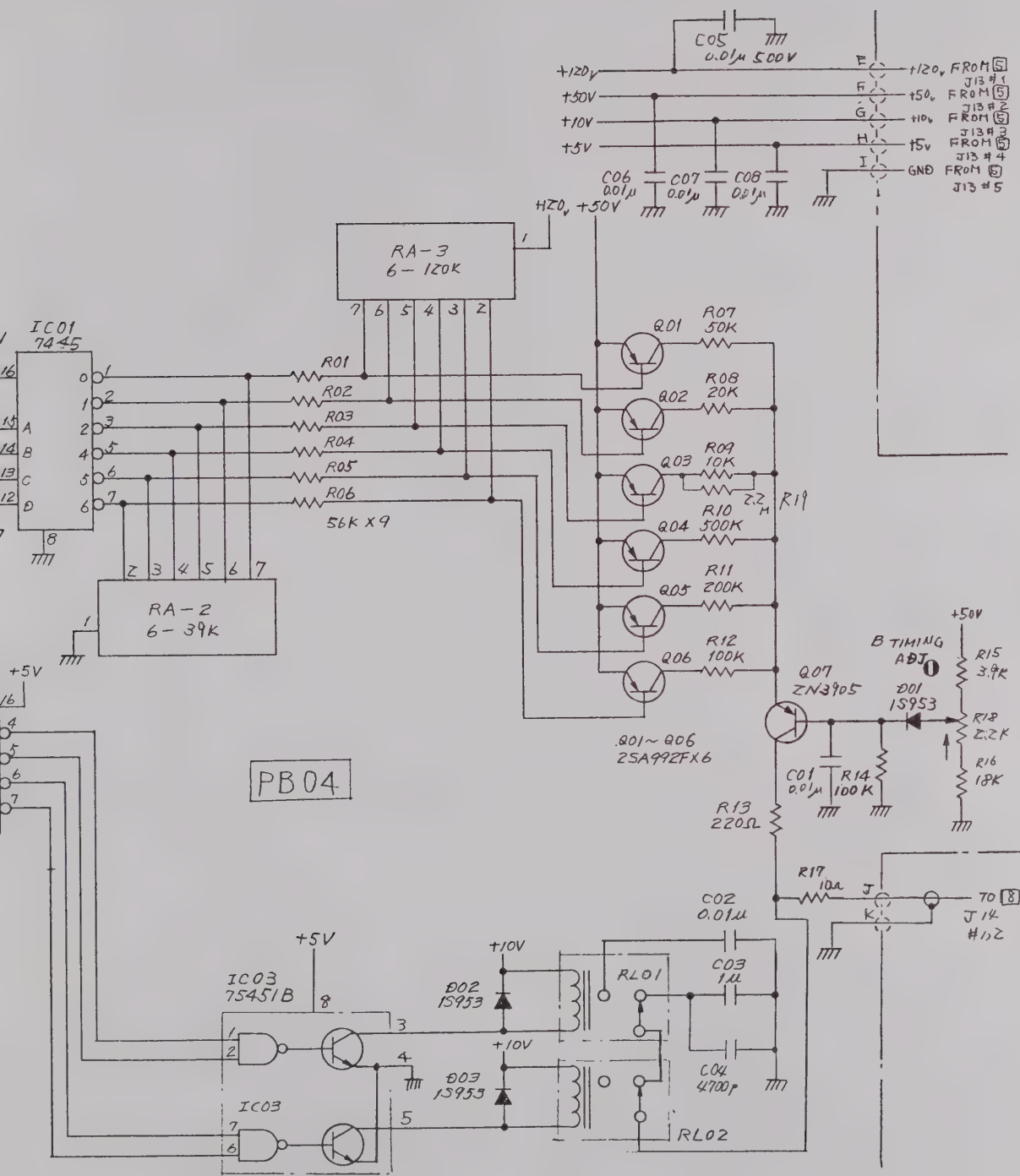
KBBSS200241



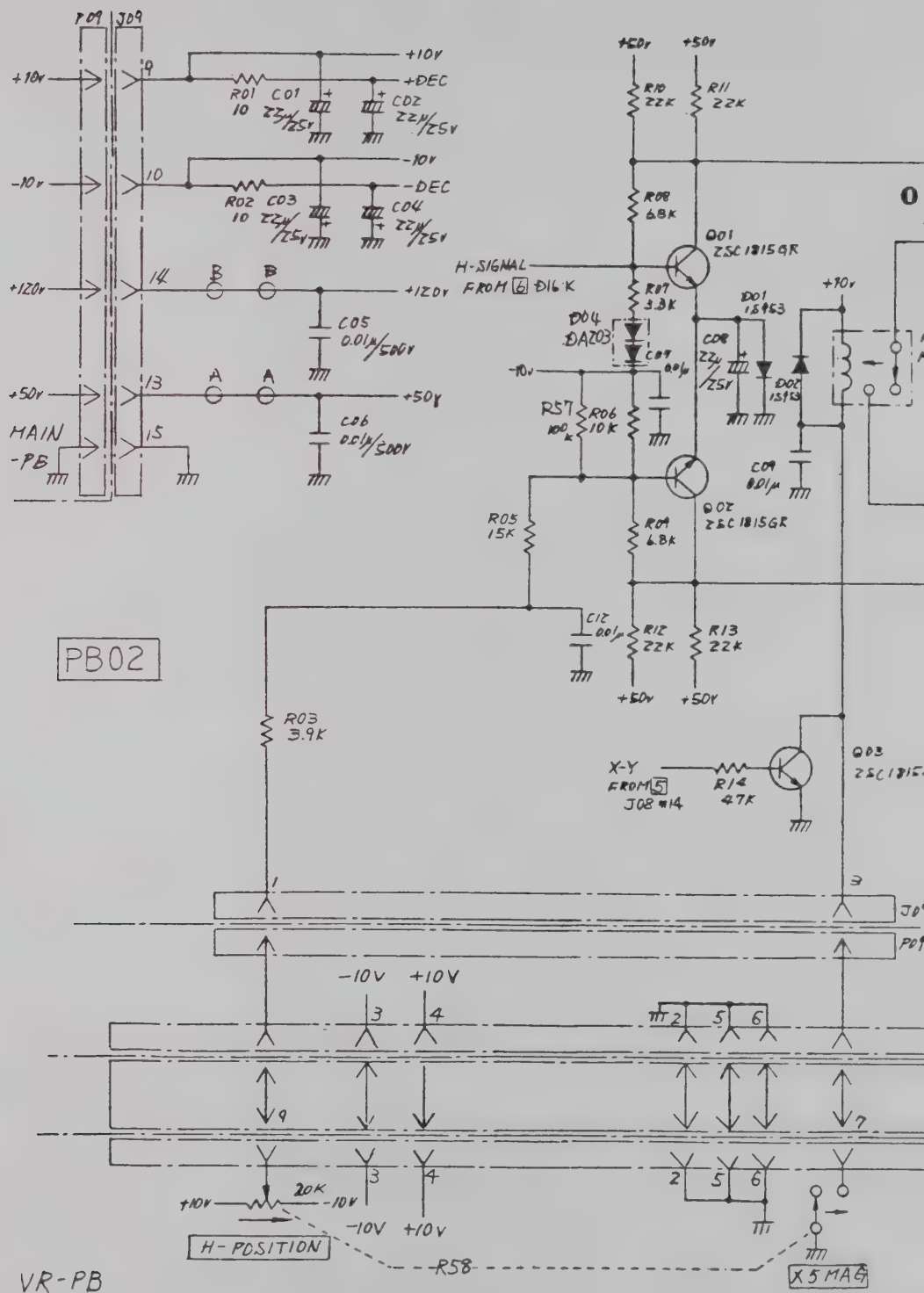


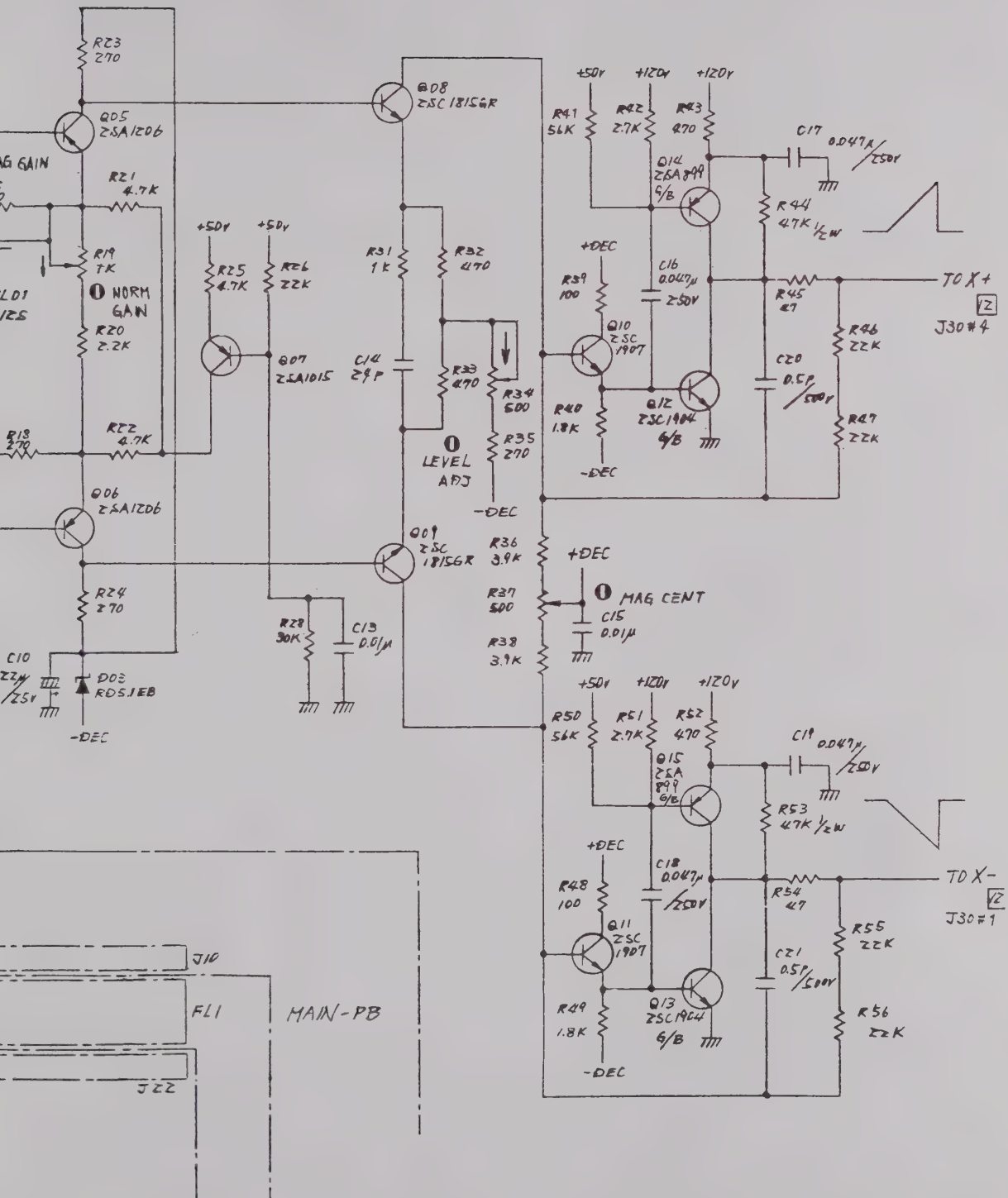
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A TIMING	
图 号	KBB SS200251



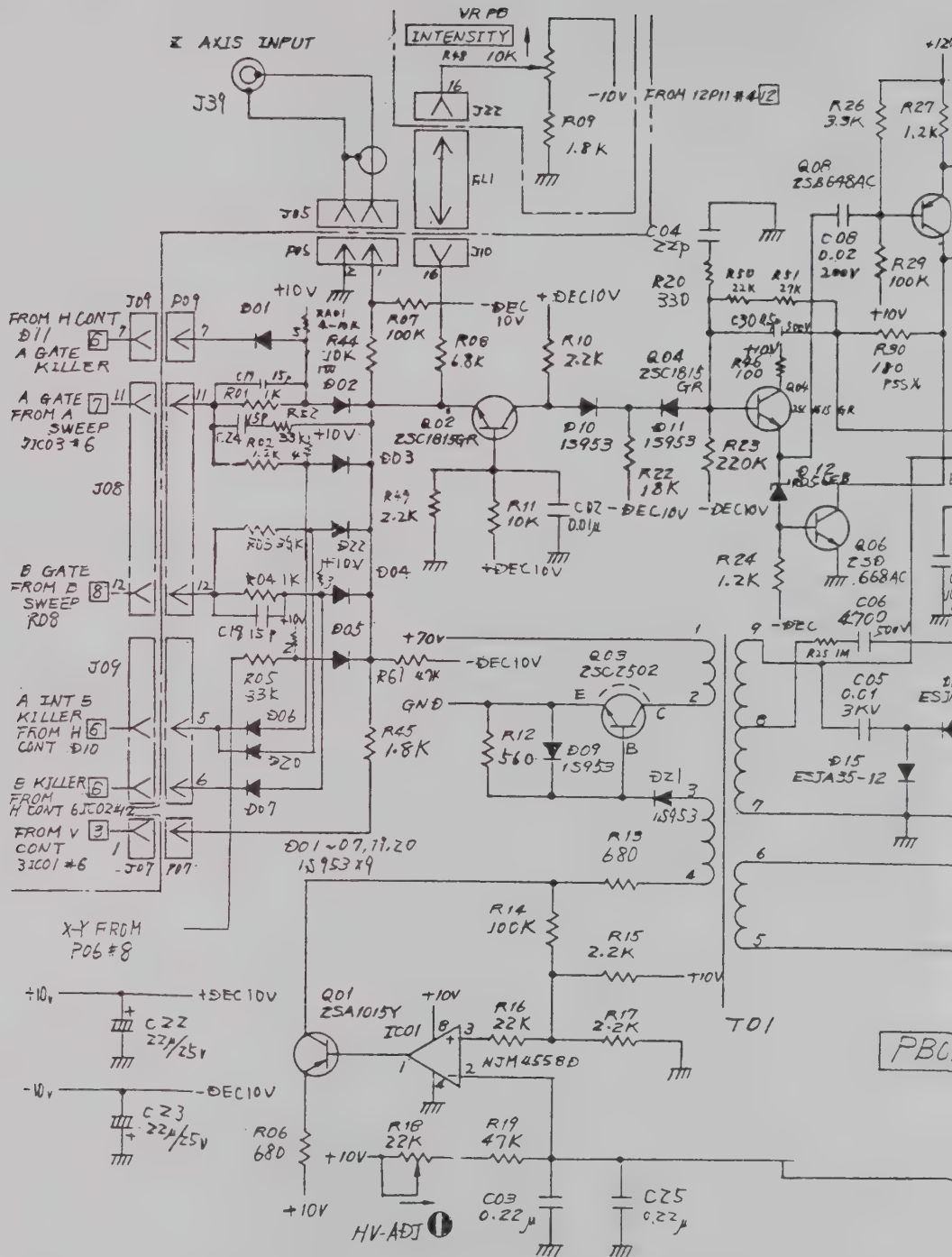


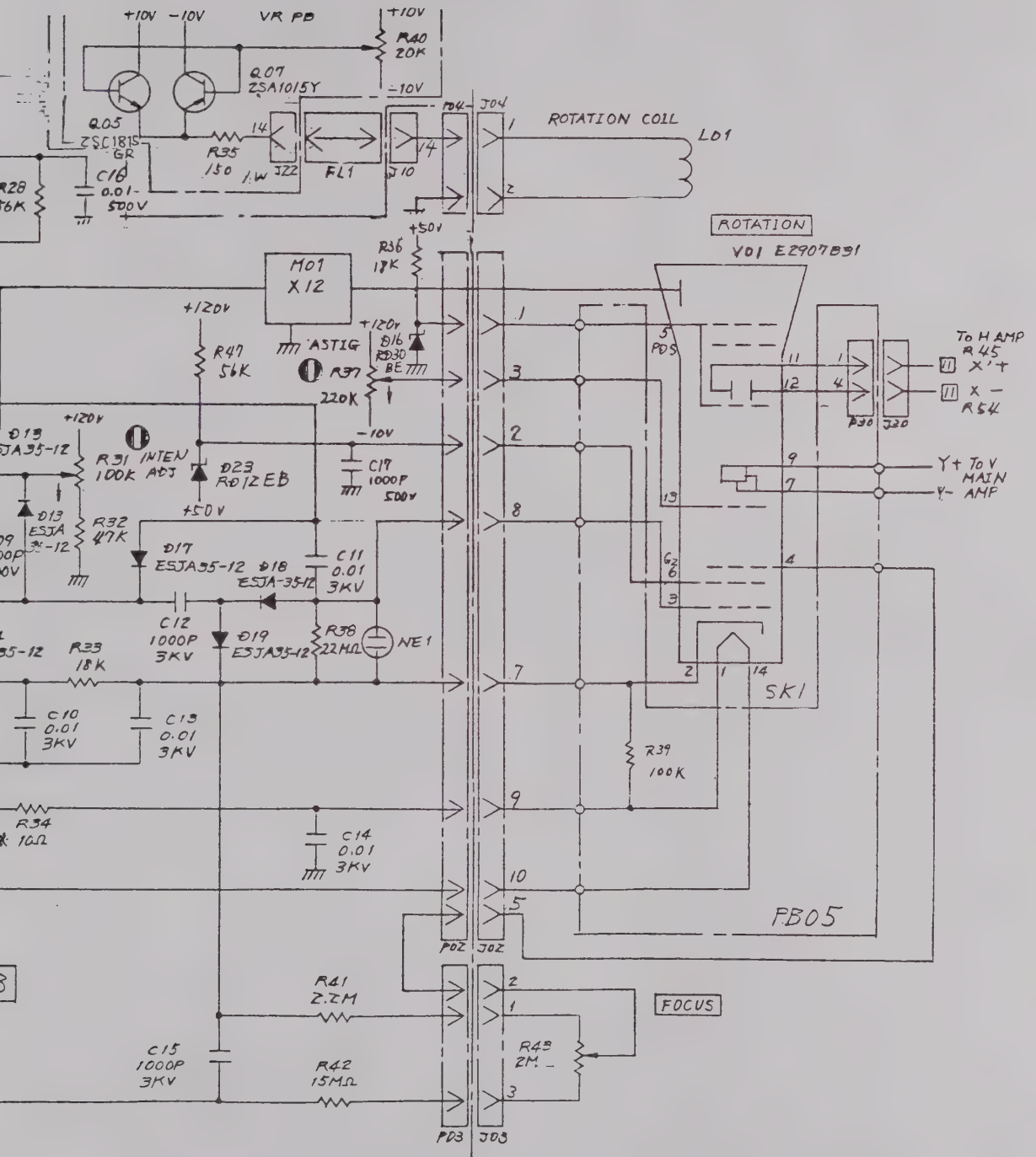
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B TIMING	
图 番	10
KBBSS20026101	



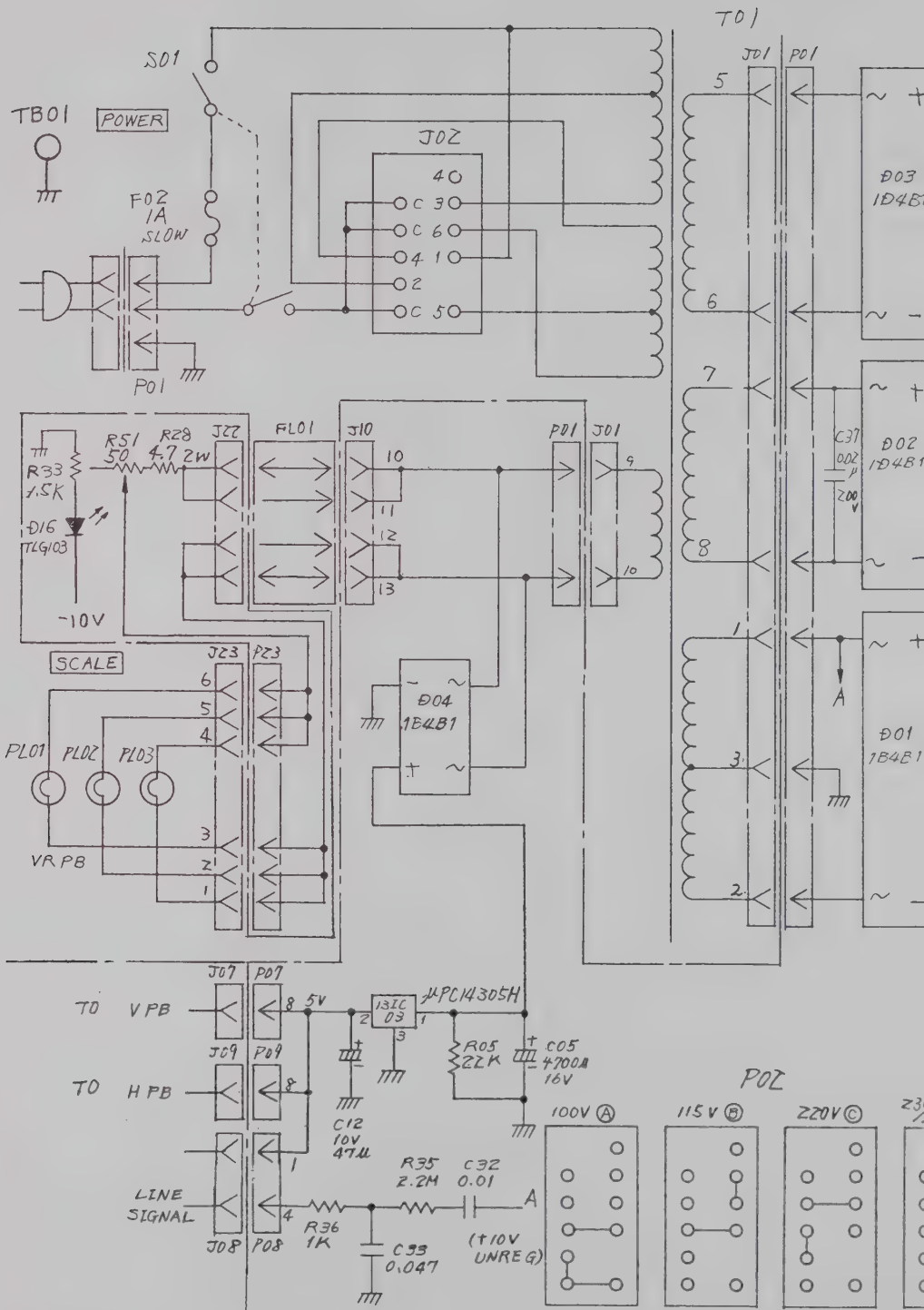


名称 SS-5704/SS-5706
 HORIZONTAL AMPLIFIER
 图号
 KBBSS24057101

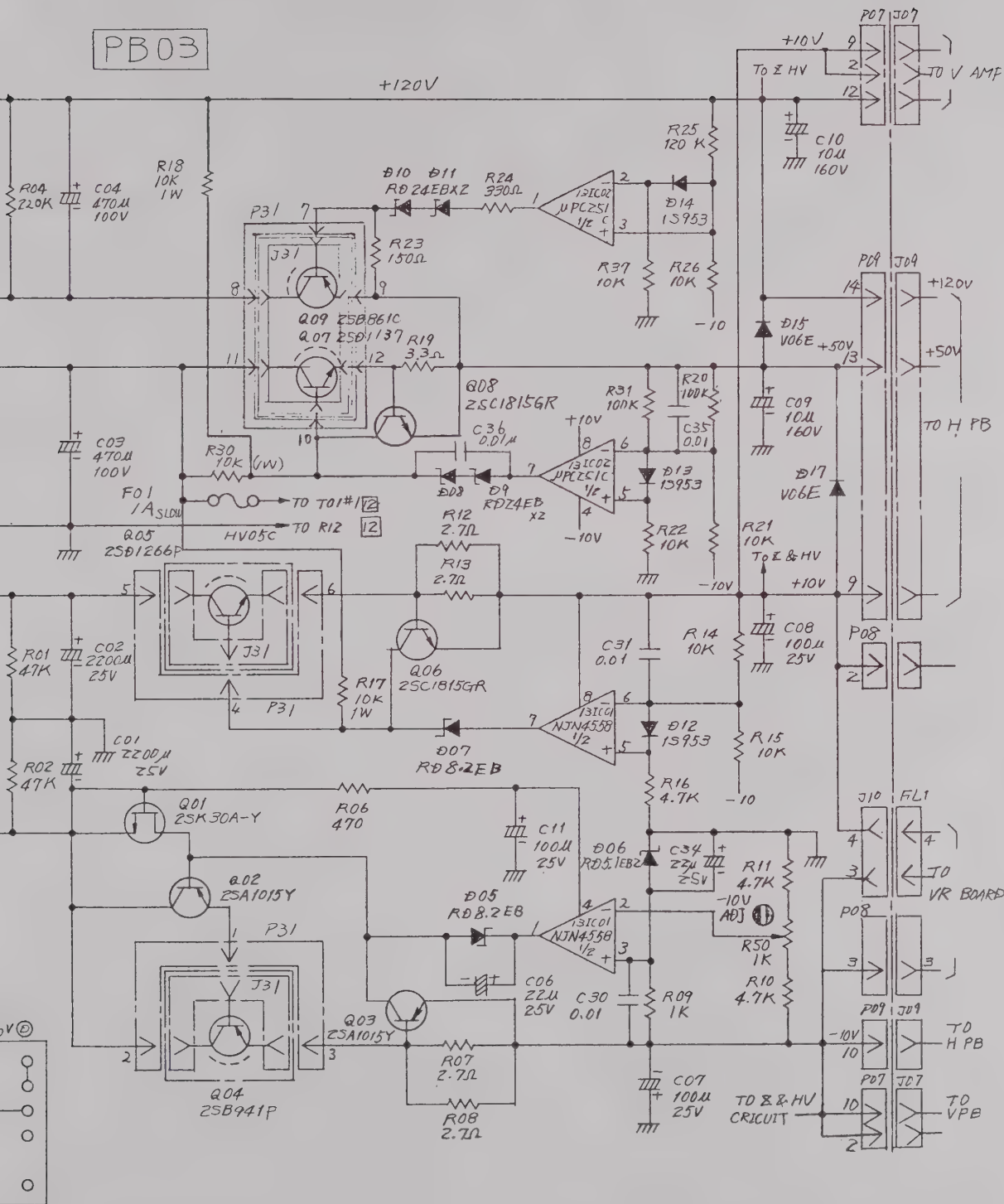




名 称 SS-5704 / SS-5706
Z AXIS & CRT CIRCUIT [12]
图 号
KBB SS41015101



PB03



名 称 SS-5704/SS-5705/SS-5706

POWER SUPPLY

13

图 号

KBBSS080131

Electrical Parts List

Ordering Information

Replacement parts may be ordered through an IWATSU representative of directly from the factory. To be certain of receiving the proper parts, a ways include the following information with the order:

- a. Model Number and serial number of the instrument on which the parts will be installed.
- b. Circuit reference number and subassembly name, if applicable for which the part is inteded. If the part does not have a circuit reference, the description from the parts list should be used.
- c. Iwatsu part number.

For factory repair, contact the IWATSU agent and include the following information:

- a. Model number and serial number of the instrument on which the work is to be performed.
 - b. Details concerning the nature of the malfunction, or, type of repair desired.
- Shipping instructions will be sent to you promptly.

How to Use This Parts List

The part list is divided into subsections corresponding to the schematic diagrams such as CH 1, & CH 2 ATTE-NUATOR, CH 1,CH 2 PRE-AMPLIFIER, CH 3 & CH 4 ATTENUATOR & PRE-AMPLIFIER, VERTICAL MAIN AMPLIFIER, VERTICAL CONTROL, A & B TRIGGER GENERATOR, A. B SWEEP GENERATOR, A & B TIMING CIRCUIT, HORIZONTAL AMPLIFIER, HORIZONTAL CONTROL, POWER SUPPLY & CALIBRATOR, Z AXIS & CRT CIRCUIT.

Component locations can be determined from the schematic diagrams, each component appears only once in the parts list. At the beginning of each subsection are listed part number for any complete subassemblies in that category that are available replacement parts. These subassemblies may include individually-listed components; care should be taken to pinpoint malfunctions to the exact replacement parts actually needed and thus avoid the time and cost involved in "over-repair".

Abbreviations

- Cap. Capacitor
 - Cer. Ceramic
 - Poly Polyethytel film
 - Elect. Aluminum electrolytic chemical
 - Elect. tan. Tan-talum electrolytic chemical condenser
 - [The symbol F (farad) is omitted]
- Res. Resistor
 - W.W Wire wound
 - Comp Composition
 - [The symbol Ω (ohm) is omitted]
- FET Field Effect Transistor
- Diode
 - T. diode. Tunnel diode
 - Z.diode Zenner diode
 - S.B.diode. Schottky barrier diode
 - V.C. diode Variable capacitance diode
 - L.E.D Light emission diode
- IC. Integrated Circuit
- Var. Variable

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
CH1 & CH2 ATTENUATOR 0			OR14	Res., 750k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938361
OC01	Cap., 0.047 μ , $\pm 20\%$, 400V, Film	DCF168011	OR15	Res., 333k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938061
OC04	Cap., 2.5 $\sim$ 22.5p, Var, 250V, Cer.	DCV019592	OR16	Res., 900k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938081
OC05	Cap., 2 $\sim$ 12p, Var, 250V, Cer.	DCV019602	OR17	Res., 111k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938341
OC06	Same as OC04		OR18	Res., 990k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938091
OC07	Same as OC05		OR19	Res., 10.1k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938311
OC08	Same as OC04		OR20	Res., 270, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939181
OC09	Same as OC05		OR21	Res., 12, $\pm 5\%$, 1/5W, Carbon	DRD931031
OC10	Cap., 68p, $\pm 5\%$, 100V, Cer.	DCC246551	OR22	Res., 1k, $\pm 5\%$, 1/5W, Carbon	DRD931041
OC12	Same as OC04		OR23	Res., 999k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE931101
OC13	Cap., 2 $\sim$ 8p, Var, 250V, Cer.	DCV019612	OR24	Res., 1.001k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938011
OC14	Cap., 470p, $\pm 5\%$, 50V, Cer.	DCC237481	OR25	Res., 390, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939201
OC16	Same as OC04		OR26	Res., 3.9, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939781
OC17	Same as OC13		OR28	Res., 82, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939121
OC19	Cap., 2700p, $\pm 5\%$, 50V, Cer.	DCC237491	OR29	Res., 27, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939061
OC21	Same as OC01		OR30	Res., 12, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939021
OC24	Same as OC04		OR31	Same as OR01	
OC25	Same as OC05		OR32	Same as OR01	
OC26	Same as OC04		OR33	Same as OR01	
OC27	Same as OC05		OR35	Same as OR01	
OC28	Same as OC04		OR36	Same as OR01	
OC29	Same as OC05		OR42	Same as OR12	
OC30	Same as OC10		OR43	Same as OR13	
OC32	Same as OC04		OR44	Same as OR14	
OC33	Same as OC13		OR45	Same as OR15	
OC34	Same as OC14		OR46	Same as OR16	
OC36	Same as OC04		OR47	Same as OR17	
OC37	Same as OC13		OR48	Same as OR18	
OC39	Same as OC19		OR49	Same as OR19	
OC40	Cap., 5p, $\pm 0.25\%$, 500V, Cer.	DCC259211	OR50	Res., 220, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939171
OC41	Same as OC40		OR51	Same as OR21	
OC42	Cap., 8p, $\pm 0.5\%$, 500V, Cer.	DCC259181	OR52	Res., 1.0k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939251
OC43	Same as OC42		OR53	Res., 999k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938101
OR01	Res., 10, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD134351	OR54	Same as OR24	
OR02	Same as OR01		OR55	Same as OR25	
OR03	Same as OR01		OR56	Res., 4.7, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939791
OR05	Same as OR01		OR58	Same as OR28	
OR06	Same as OR01		OR59	Same as OR29	
OR12	Res., 500k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938071	OR60	Res., 8.2, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939821
OR13	Res., 1M, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938371	OS01	Push switch, SUJ12A	DSW014831
			OS02	Same as OS01	

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
OS03	Switch, PS22BH4-5-11	DSW034712			
OS04	Same as OS01				
OS05	Same as OS01				
OS06	Same as OS03				
OJ35	BNC connector, 080	DCN040711			
OJ36	Same as OJ35				
OTB01	Ground terminal, B(8φ)	DTA020501			

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
CH1	PREAMPLIFIER 1		1R09	Res., 10k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939371
1C01	Cap., 1000p, $\pm 10\%$, 500V, Cer.	DCC151801	1R10	Same as 1R05	
1C03	Cap., 22μ , $\pm 20\%$, 25V, Elect.	DCE229041	1R11	Res., 100, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939131
1C04	Same as 1C03		1R12	Res., 1.5k, $\pm 1\%$, $\frac{1}{5}W$, Metal	DRE999271
1C05	Cap., 0.01μ , $+80\% \sim -20\%$, 50V, Cer.	DCC139511	1R13	Res., B100, Var., 0.5W, Metal	DRV430541
1C06	Cap., $2 \sim 8p$, Var, 250V, Cer.	DCV019592	1R14	Res., 2.7k, $\pm 1\%$, $\frac{1}{5}W$, Metal	DRE999301
1C12	Cap., 330p, $\pm 5\%$, 50V, Cer.	DCC239181	1R15	Same as 1R14	
1C13	Cap., 0.0022μ , $\pm 10\%$, 50V, Film	DCF129721	1R16	Same as 1R12	
1C14	Cap., 12p, $\pm 5\%$, 50V, Cer.	DCC239321	1R17	Res., B200, Var., 0.3W, Metal	DRV411731
1C16	Cap., 1000p, $\pm 10\%$, 50V, Cer.	DCC139051	1R18	Res., 33, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939071
1C17	Cap., 180p, $\pm 5\%$, 50V, Cer.	DCC239271	1R19	Res., 2.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939291
1C18	Same as 1C16		1R20	Res., 2.7k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939301
1C20	Cap., 3p, Var, 50V, Cer.	DCC230701	1R21	Res., 3.9k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939321
1C21	Same as 1C05		1R22	Res., 270, $\pm 1\%$, $\frac{1}{5}W$, Metal	DRE999181
1C22	Same as 1C03		1R23	Same as 1R13	
1C24	Same as 1C05		1R24	Res., 470, $\pm 1\%$, $\frac{1}{5}W$, Metal	DRE999211
1C29	Cap., 0.022μ , $\pm 10\%$, 50V, Film	DCF129041	1R25	Res., 1.0k, $\pm 1\%$, $\frac{1}{5}W$, Metal	DRE999251
1C30	Same as 1C03		1R26	Res., B200, Var., 0.3W, Metal	DRV412011
1C33	Cap., 47p, $\pm 5\%$, 50V, Cer.	DCC239031	1R27	Same as 1R25	
1C34	Same as 1C05		1R28	Res., 47, $\pm 1\%$, $\frac{1}{5}W$, Metal	DRE999091
1C35	Same as 1C05		1R29	Res., 680, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939231
1C38	Same as 1C05		1R30	Same as 1R29	
1C41	Same as 1C05		1R31	Res., 120, $\pm 1\%$, $\frac{1}{5}W$, Metal	DRE999141
1C42	Cap., 120p, $\pm 5\%$, 50V, Cer.	DCC239261	1R32	Res., 22, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939051
1C44	Same as 1C05		1R33	Res., 27, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939061
1C45	Cap., 0.01μ , $+80 \sim -20\%$, 50V, Cer.	DCC139511	1R34	Res., B1k, Var., 0.25W Carbon	DRV146001
1C50	Cap., 12p, $\pm 5\%$, 50V, Cer.	DCC239321	1R35	Same as 1R33	
1C71	Same as 1C45		1R36	Same as 1R05	
1C72	Same as 1C45		1R37	Same as 1R22	
1C73	Same as 1C05		1R38	Res., 6.8k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939351
1R01	Res., 470k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD145471	1R39	Same as 1R38	
1R02	Res., 1M, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE930221	1R41	Same as 1R25	
1R03	Res., B22k, Var., 0.5W, Metal	DRV430701	1R42	Same as 1R19	
1R04	Res., 100, $\pm 1\%$, $\frac{1}{5}W$, Metal	DRE999131	1R43	Same as 1R25	
1R05	Res., 56, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939101	1R44	Same as 1R22	
1R06	Same as 1R04		1R45	Same as 1R29	
1R07	Res., 4.7k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939331	1R46	Same as 1R22	
1R08	Same as 1R07		1R47	Same as 1R22	
			1R48	Same as 1R29	
			1R49	Same as 1R26	
			1R50	Same as 1R29	
			1R51	Same as 1R29	

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
1R52	Same as 1R38		1D12	Same as 1D02	
1R54	Same as 1R18		1D13	Same as 1D02	
1R57	Same as 1R38		1D14	Same as 1D01	
1R58	Same as 1R29		1D20	Diode array DAP201	DDD991081
1R59	Res., 1.2k, $\pm 1\%$, 1/5W, Metal	DRE999261	1D21	Same as 1D20	
1R61	Same as 1R19				
1R62	Same as 1R28		1Q01	Transistor, μ PA 61AL	DTR295361
1R63	Same as 1R38		1Q02	Transistor, 2SC1815-GR	DTR137781
1R64	Res., 1.0k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939251	1Q03	Same as 1Q02	
1R65	Same as 1R64		1Q04	Transistor, 2SC1815GR	DTR139011
1R66	Same as 1R09		1Q05	Same as 1Q04	
1R69	Res., 3.9k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939321	1Q06	Transistor, 2SC2901	DTR135741
1R70	Res., 470, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939211	1Q07	Same as 1Q04	
1R72	Res., 22k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939411	1Q08	Same as 1Q04	
1R73	Same as 1R11		1Q09	Transistor, 2SA 1206	DTR115301
1R74	Same as 1R11		1Q10	Same as 1Q09	
1R78	Same as 1R05		1Q11	Same as 1Q09	
1R79	Same as 1R11		1Q12	Same as 1Q04	
1R80	Same as 1R11		1Q13	Same as 1Q04	
1R81	Res., 12k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939381	1Q14	Same as 1Q09	
1R82	Same as 1R81		1Q15	Same as 1Q04	
1R83	Same as 1R07		1Q16	Same as 1Q04	
1R84	Same as 1R07		1Q17	Same as 1Q09	
1R85	Same as 1R59		1Q18	Same as 1Q04	
1R86	Res., 180, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939161	1Q19	Same as 1Q04	
1R87	Same as 1R81		1Q20	Transistor 2SC 1907	DTR137611
1R88	Same as 1R81		1Q21	Transistor, 2SA 1015Y	DTR119011
1R89	Same as 1R05		1Q22	Same as 1Q21	
1R90	Same as 1R29		1Q23	Same as 1Q23	
1R91	Same as 1R70		1Q24	Transistor 2SC 1815GR	DTR139011
1R92	Same as 1R70				
1R93	Res., 47, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939091	1P00	Connector, M36-02-30-114P	DCN034851
1R94	Res., 330, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939191	1P06	Connector, 5243-12C	DCN991151
1R97	Res., 100, $\pm 15\%$, Thermistor	DDD080331	1P24	Connector, M33-12-30-114P	DCN034731
1R98	Same as 1R24		1P27	Connector, M36-02-30-114P	DCN034851
1R99	Same as 1R11				
1R02A	Res., 390, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939201	1J00	Connector, M36-M87-02	DCN034601
			1J06	Connector, 5124-12BHPH	DCN990621
1D01	Diode 1S1544A	DDD010801	1J24	Connector, M31-M87-12	DCN034541
1D02	Diode 1S953	DDD010821	1J27	Connector, M36-M87-02	DCN034601
1D04	Diode TLR206	DDD070181	1J37	Connector, BNC080	DCN040711
1D11	Same as 1D02				

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
CH2	PREAMPLIFIER	2			
2C01	Cap., 1000p, $\pm 10\%$, 500V, Cer.	DCC151801	2R17	Res., B200, Var, 0.3W, Metal	DRV411731
2C02	Cap., 22 μ , $\pm 20\%$, 25V, Elect.	DCE229041	2R18	Res., 270, $\pm 1\%$, 1/5W, Metal	DRE999181
2C04	Same as 2C02		2R21	Res., 56, $\pm 1\%$, 1/5W, Metal	DRE999101
2C05	Cap., 0.01 μ , +80 $\sim$ -20%, 50V, Cer.		2R22	Res., 27, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939061
		DCC139511	2R23	Res., B1k, Var, 0.25W, Carbon	DRV146001
2C06	Cap., 2 $\sim$ 8p, Var, 250V, Cer.	DCV019592	2R24	Same as 2R22	
2C12	Cap., 12p, $\pm 5\%$, 50V, Cer.	DCC239321	2R25	Same as 2R21	
2C14	Cap., 1000p, $\pm 10\%$, 50V, Cer.	DCC139051	2R26	Res., 6.8k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939351
2C15	Cap., 180p, $\pm 5\%$, 50V, Cer.	DCC239271	2R27	Same as 2R26	
2C16	Same as 2C14		2R28	Same as 2R18	
2C17	Cap., 0.022 μ , $\pm 10\%$, 50V, Film	DCF129041	2R29	Res., B1k, Var, 0.3W, Metal	DRV412031
2C18	Same as 2C05		2R30	Res., 2.2k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939291
2C20	Same as 2C05		2R31	Res., 1.0k, $\pm 1\%$, 1/5W, Metal	DRE999251
2C21	Same as 2C02		2R32	Same as 2R18	
2C22	Same as 2C05		2R33	Res., 680, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939231
2C23	Same as 2C05		2R34	Same as 2R18	
2C24	Same as 2C02		2R35	Res., 470, $\pm 1\%$, 1/5W, Metal	DRE999211
2C31	Same as 2C05		2R36	Same as 2R18	
2C32	Same as 2C05		2R37	Res., B200, Var, 0.3W, Metal	DRV412011
2C41	Same as 2C05		2R38	Res., 470, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939211
2C50	Cap., 12p, $\pm 5\%$, 50V, Cer.	DCC239321	2R39	Res., 560, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939221
2C51	Cap., 3p, $\pm 0.25\%$, 50V, Cer.	DCC230701	2R40	Same as 2R33	
2C71	Same as 2C05		2R41	Same as 2R26	
2C72	Same as 2C05		2R42	Res., 120, $\pm 1\%$, 1/5W, Metal	DRE999141
			2R43	Res., B20k, Var, 0.25W, Carbon	DRV146951
2R01	Res., 470k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD145471	2R44	Res., 22k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939411
2R02	Res., 1M, $\pm 0.5\%$, $\frac{1}{4}$ W, Metal	DRE930221	2R45	Same as 2R33	
2R03	Res., B22k, Var, 0.5W, Metal	DRV430701	2R46	Res., 47, $\pm 1\%$, 1/5W, Metal	DRE999091
2R04	Res., 100, $\pm 1\%$, 1/5W, Metal	DRE999131	2R47	Res., 1.0k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939251
2R05	Res., 56, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939101	2R48	Res., 2.0k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939621
2R06	Same as 2R04		2R49	Res., 8.2k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939361
2R07	Res., 4.7k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939331	2R54	Res., 680, $\pm 1\%$, 1/5W, Metal	DRE999231
2R08	Same as 2R07		2R55	Same as 2R26	
2R09	Res., 10k, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939371	2R58	Same as 2R11	
2R10	Same as 2R05		2R59	Same as 2R11	
2R11	Res., 100, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939131	2R64	Same as 2R11	
2R12	Res., 1.5k, $\pm 1\%$, 1/5W, Metal	DRE999271	2R65	Same as 2R11	
2R14	Res., 2.7k, $\pm 1\%$, 1/5W, Metal	DRE999301	2R70	Same as 2R32	
2R15	Same as 2R14		2R71	Res., 47, $\pm 5\%$, $\frac{1}{4}$ W, Carbon	DRD939091
2R16	Same as 2R12		2R74	Same as 2R33	
			2R77	Same as 2R11	

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
2D01	Diode 1S1544A	DDD010801			
2D02	Diode 1S953	DDD010821			
2D03	Diode DAP201	DDD991081			
2D04	Same as 2D03				
2D05	Same as 2D01				
2Q01	Transistor, μ PA61AL	DTR295361			
2Q02	Transistor, 2SC1815GR	DTR137781			
2Q03	Same as 2Q02	DTR139011			
2Q04	Transistor, 2SC1815GR	DTR137611			
2Q05	Same as 2Q04				
2Q06	Transistor, 2SA1206	DTR115301			
2Q07	Same as 2Q06				
2Q07	Same as 2Q06				
2Q09	Same as 2Q04				
2Q10	Same as 2Q04				
2Q11	Same as 2Q06				
2Q12	Transistor 2SC1907	DTR137611			
2Q13	Same as 2Q12				
2Q14	Same as 2Q04				
2Q15	Same as 2Q04				
2Q16	Same as 2Q04				
2Q17	Same as 2Q04				

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
VERTICAL CONTROL 3			3R18	Same as 3R16	
3C00	Cap., 1p, $\pm 0.25\%$, 50V, Cer.	DCC230301	3R20	Same as 3R17	
3C02	Cap., 2200p, Var, 50V, Film	DCC239191	3R21	Same as 3R05	
3C03	Cap., 1p, $\pm 0.25\%$, 50V, Cer.	DCC239191	3R23	Res., 390, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939201
3C04	Cap., 15p, $\pm 5\%$, 50V, Cer.	DCC239221	3R24	Res., 100, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939131
3C05	Cap., 1000p, $\pm 10\%$, 50V, Cer.	DCC139051	3R25	Res., 68, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939111
3C06	Cap., 2.5~22.5p, Var, 250V, Cer.	DCV019602	3R28	Same as 3R24	
3C08	Same as 3C05		3R29	Same as 3R23	
3C09	Same as 3C04		3R30	Res., 390, $\pm 1\%$, 1/5W, Metal	DRE999201
3C10	Cap., 220p, $\pm 5\%$, 50V, Cer.	DCC234501	3R31	Same as 3R25	
3C11	Cap., 470p, $\pm 5\%$, 50V, Cer.	DCC235301	3R32	Same as 3R05	
3C14	Cap., 56p, $\pm 5\%$, 50V, Cer.	DCC239251	3R33	Same as 3R30	
3C16	Cap., 22 μ , $\pm 20\%$, 25V, Cer.	DCE229041	3R35	Same as 3R05	
3C17	Same as 3C16		3R36	Res., 22, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939051
3C18	Same as 3C16		3R37	Res., 2.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939291
3C20	Same as 3C16		3R38	Res., 15k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939391
3C22	Cap., 0.01 μ , +80~-20%, 50V, Cer.		3R39	Res., 1.0M, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939611
		DCC139501	3R40	Same as 3R05	
3C23	Same as 3C22		3R41	Same as 3R37	
3C24	Same as 3C22		3R42	Res., 22k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939411
3C25	Same as 3C22		3R44	Res., 47k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939451
3C71	Same as 3C22		3R45	Res., B470, Var, 0.5W, Metal	DRV430561
3C72	Same as 3C22		3R46	Res., 4.7k, $\pm 1\%$, 1/5W, Metal	DRE999331
3C80	Cap., 22 μ , $\pm 20\%$, 25V, Cer.	DCE225151	3R48	Res., 100k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939491
3R00	Res., 18k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD135131	3R50	Res., 1.8k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939281
3R01	Res., 330k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD238431	3R53	Same as 3R24	
3R02	Res., 1.0k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939251	3R54	Same as 3R24	
3R04	Res., 10k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939371	3R55	Res., 12k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939381
3R05	Res., 4.7k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939331	3R58	Same as 3R37	
3R06	Res., 56, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939101	3R60	Res., B20k, Var, 0.25W, Carbon	DRV146981
3R07	Same as 3R06		3R61	Same as 3R48	
3R08	Res., 1.8k, $\pm 1\%$, 1/5W, Metal	DRE999281	3R62	Same as 3R04	
3R09	Same as 3R08		3R63	Same as 3R04	
3R10	Res., 2.7k, $\pm 1\%$, 1/5W, Metal	DRE999301	3R65	Same as 3R06	
3R11	Res., B5k, Var, 0.3W, Metal	DRV412051	3R70	Same as 3R42	
3R12	Res., 820, $\pm 1\%$, 1/5W, Metal	DRE999241	3R71	Same as 3R42	
3R13	Same as 3R04		3R72	Same as 3R05	
3R14	Same as 3R02		3R73	Same as 3R55	
3R15	Same as 3R12		3R80	Res., 1k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD931041
3R16	Res., 1.5k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939271	3R99	Res., 47, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939091
3R17	Res., 330, $\pm 1\%$, 1/5W, Metal	DRE999191	3RA01	Res., 10k, $\pm 5\%$, 1/8W, Carbon	DFB015541

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
3RA02	Res., 100k, $\pm 5\%$, 1/8W, Carbon	DFB017661	3J11	Connector, M36-M87-02	DCN034601
			3J16	Connector, M33-M87-03	DCN034561
3D01	Diode 1S953	DDD010821			
3D02	Same as 3D01		3IC01	IC, TC 4069UBP	DIC420621
3D03	Same as 3D01		3IC02	IC, TC 4520BP	DIC422081
3D04	Same as 3D01		3IC03	IC, TC 4027BP	DIC420261
3D05	Same as 3D01		3IC04	IC, TC4011BP	DIC420101
3D06	Same as 3D01		3IC05	Same as 3IC04	
3D07	Same as 3D01				
3D08	Same as 3D01		3P07	Connector, 5243-12C	DCN991151
3D09	Same as 3D01		3P11	Connector, M36-02-30-114P	DCN034851
3D10	Same as 3D01		3P16	Connector, M33-03-30-114P	DCN034651
3D11	Same as 3D01				
3D12	Same as 3D01				
3D13	Same as 3D01				
3D14	Same as 3D01				
3D15	Same as 3D01				
3D16	Same as 3D01				
3D17	Same as 3D01				
3D18	Diode, DAP201	DDD991081			
3D19	Same as 3D18				
3D22	Same as 3D18				
3D24	Same as 3D01				
3Q01	Transistor, 2SA1206	DTR115301			
3Q02	Same as 3Q01				
3Q03	Transistor, 2SC1815GR	DTR139011			
3Q04	Same as 3Q03				
3Q05	Same as 3Q03				
3Q06	Transistor, 2SC2901	DTR135741			
3Q07	Same as 3Q06				
3Q08	Same as 3Q03				
3Q09	Same as 3Q03				
3Q10	Transistor, 2SA1015Y	DTR119011			
3Q11	Same as 3Q10				
3Q12	Transistor, 114-A	DTR190941			
3Q13	Same as 3Q12				
3Q14	Same as 3Q03				
3S01	Switch, SUJ55A	DSW014731			
3J07	Connector, 5124-12BHBP	DCN990621			

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
VERTICAL MAIN AMPLIFIER 4			4R20	Res., 680, $\pm 1\%$, 1/5W, Metal	DRE999231
4C00	Cap., 1500p, $\pm 10\%$, 50V, Cer.	DCF129011	4R21	Res., 1.2k, $\pm 1\%$, 1/5W, Metal	DRE999261
4C02	Cap., 22p, $\pm 5\%$, 50V, Cer.	DCC239121	4R22	Same as 4R21	
4C03	Cap., 6p, $\pm 0.5\%$, 50V, Cer.	DCC239091	4R23	Same as 4R20	
4C05	Cap., 2.5~22.5p, Var, 250V, Cer.	DCV019592	4R24	Res., 10k, $\pm 5\%$, 2W, Metal	DRS231271
4C06	Cap., 62p, $\pm 5\%$, 50V, Cer.	DCC233501	4R27	Res., 100, $\pm 5\%$, 1/4W, Carbon	DRD939131
4C08	Cap., 22 μ , $\pm 20\%$, 25V, Elect.	DCE229041	4R29	Res., 68, $\pm 5\%$, 1/4W, Carbon	DRD939111
4C09	Cap., 1.5 μ , $\pm 0.25\%$, 500V, Cer.	DCC250401	4R31	Same as 4R24	
4C11	Cap., 0.1 μ , $\pm 10\%$, 50V, Film	DCF129721	4R32	Res., 220, $\pm 5\%$, 1/4W, Carbon	DRD939171
4C13	Same as 4C09		4R33	Same as 4R29	
4C15	Cap., 0.047 μ , $\pm 20\%$, 200V, Film,	DCF160291	4R34	Res., 22k, $\pm 5\%$, 1W, Carbon	DRS220591
4C16	Same as 4C15		4R35	Res., 56, $\pm 5\%$, 1/4W, Carbon	DRD939101
4C18	Cap., 0.047 μ , $\pm 20\%$, 200V, Film	DCF160291	4R36	Same as 4R32	
4C19	Same as 4C18		4R37	Res., 15k, $\pm 5\%$, 1W, Carbon	DRS229371
4C21	Cap., 1000p, $\pm 10\%$, 500V, Cer.	DCC151801	4R39	Same as 4R35	
4C22	Cap., 1000p, $\pm 10\%$, 50V, Cer.	DCF129071	4R40	Res., 1.0k, $\pm 5\%$, 1/4W, Carbon	DRD939251
4C23	Same as 4C22		4R42	Same as 4R37	
4C25	Cap., 0.01 μ , $\pm 10\%$, 500V, Cer.	DCC153561	4R43	Res., 220, $\pm 1\%$, 1/5W, Metal	DRE999171
4C26	Cap., 0.01 μ , +80~-20%, 50V, Cer.	DCC139501	4R44	Same as 4R43	
4C27	Same as 4C26		4R50	Res., 270, $\pm 5\%$, 1/4W, Carbon	DRD939181
4C28	Same as 4C26		4R51	Same as 4R50	
4C30	Same as 4C02		4R52	Res., 4.7k, $\pm 5\%$, 1/4W, Carbon	DRD939331
4C32	Same as 4C08		4R55	Res., 12k, $\pm 5\%$, 1/4W, Carbon	DRD939381
4C33	Same as 4C08		4R56	Res., B50k, Var, 0.3W, Metal	DRV412061
4C36	Cap., 6800p, $\pm 10\%$, 50V, Film	DCF129201	4R62	Same as 4R40	
4R00	Res., 27k, $\pm 5\%$, 1/4W, Carbon	DRD939421	4R80	Res., 180k, $\pm 5\%$, 1/4W, Carbon	DRD939521
4R01	Res., 180, $\pm 5\%$, 1/4W, Carbon	DRD939161	4D06	Diode RD6.2EB2	DDD033121
4R03	Res., 1.0k, $\pm 1\%$, 1/5W, Metal	DRE999251	4D07	Same as 4D06	
4R04	Res., 100, $\pm 15\%$, Thermistor	DDD080331	4D08	Diode RD5.1EB1	DDD032071
4R05	Res., B50k, Var, 0.3W, Metal	DRV412061	4P26	Connector, M33-03-30-114P	DCN034651
4R06	Res., 82, $\pm 1\%$, 1/5W, Metal	DRE999121	4Q01	Transistor, 2SA1206	DTR115301
4R07	Res., 120, $\pm 1\%$, 1/5W, Metal	DRE999141	4Q02	Same as 4Q01	
4R08	Same as 4R06		4Q03	Transistor, 2SC1815GR	DTR139011
4R13	Res., 150, $\pm 1\%$, 1/5W, Metal	DRE999151	4Q04	Same as 4Q03	
4R14	Same as 4R13		4Q05	Transistor 2SC2037	DTR137591
4R16	Res., 100, $\pm 5\%$, 0.3W, Carbon	DRD239011	4Q08	Same as 4Q05	
4R18	Res., 270, $\pm 1\%$, 1/5W, Metal	DRE999181	4Q09	Transistor 2SD668AC	DTR145381
			4Q10	Transistor 2SB648AC	DTR125191
			4Q11	Same as 4Q09	
			4Q12	Same as 4Q10	

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CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
TRIGGER GENERATOR 5			5R12	Same as 5R01	
5C01	Cap., 0.047 μ , $\pm 20\%$, 250V, Film	DCF168011	5R13	Res., 680k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939591
5C02	Cap., 1500p, $\pm 10\%$, 50V, Film	DCF129011	5R14	Res., 1M, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938371
5C03	Cap., 1000p, $\pm 10\%$, 50V, Film	DCF129071	5R15	Res., 4.7, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939791
5C04	Cap., 0.01 μ , $\pm 10\%$, 50V, Film	DCF129051	5R16	Res., 1.5k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939271
5C05	Cap., 0.01 μ , +80 $\sim$ -20%, 50V, Cer.	DCC139501	5R17	Res., 4.7k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939331
5C07	Same as 5C05		5R18	Res., 470, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939211
5C08	Same as 5C05		5R19	Res., 100, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939131
5C09	Same as 5C05		5R20	Res., 47, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939091
5C10	Cap., 0.1 μ , $\pm 20\%$, 50V, Cer.	DCC139551	5R21	Res., 39, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939081
5C11	Same as 5C05		5R22	Res., B100, Var, 0.3W, Metal	DRV412001
5C12	Same as 5C05		5R23	Res., 3.9k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939321
5C13	Same as 5C10		5R24	Res., 2.7k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939301
5C14	Cap., 330p, $\pm 5\%$, 50V, Cer.	DCC239181	5R25	Res., 1.0k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939251
5C15	Same as 5C05		5R26	Same as 5R25	
5C16	Same as 5C05		5R27	Res., 1.0M, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939611
5C18	Cap., 18p, $\pm 5\%$, 500V, Cer.	DCC259191	5R28	Same as 5R13	
5C19	Cap., 0.022 μ , $\pm 10\%$, 50V, Film	DCF129041	5R29	Same as 5R03	
5C20	Same as 5C05		5R30	Same as 5R19	
5C21	Same as 5C05		5R31	Same as 5R02	
5C22	Cap., 82p, $\pm 5\%$, 100V, Cer.	DCC249501	5R33	Res., 2.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939291
5C23	Same as 5C05		5R34	Same as 5R19	
5C24	Cap., 1000p, $\pm 10\%$, 500V, Cer.	DCC159011	5R35	Res., 270, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939181
5C26	Same as 5C05		5R36	Same as 5R03	
5C50	Cap., 2.2p, $\pm 20\%$, 50V, Elect.	DCE245031	5R37	Res., 33, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939071
5C51	Cap., 22p, $\pm 20\%$, 25V, Elect.	DCE229041	5R38	Res., 100, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939131
5C52	Same as 5C51		5R39	Res., 220, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939171
5C53	Same as 5C51		5R40	Same as 5R17	
5C54	Same as 5C51		5R42	Same as 5R25	
5C55	Same as 5C51		5R43	Same as 5R17	
5R01	Res., 22k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939411	5R44	Same as 5R41	
5R02	Res., 3.3k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939311	5R45	Same as 5R19	
5R03	Res., 100k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939491	5R46	Res., 2.2, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD134191
5R06	Res., 22k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939411	5R47	Same as 5R27	
5R07	Same as 5R03		5R49	Res., 10k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939371
5R08	Res., 18k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939401	5R51	Res., 68, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939111
5R09	Res., 12k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939381	5R52	Res., 470k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939571
5R10	Res., 470k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939571	5R53	Same as 5R33	
5R11	Same as 5R01		5R57	Same as 5R20	
			5R58	Same as 5R49	
			5R60	Res., 5.6k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939341
			5R61	Same as 5R49	

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
5R62	Same as 5R20		5IC01	IC, TC4066BP	DIC420591
5R63	Same as 5R20				
5D01	Diode 1k34A	DDD010101			
5D02	Diode 1S953	DDD010821			
5D03	Same as 5D02				
5D04	Same as 5D02				
5D05	Same as 5D02				
5D06	Diode 1S1544A	DDD010801			
5D07	Same as 5D06				
5Q01	Transistor 2SC 1815GR	DTR139011			
5Q02	Transistor DTC 114-A	DTR190941			
5Q03	Same as 5Q01				
5Q05	Same as 5Q01				
5Q06	Transistor μ PA 61AL	DTR295361			
5Q07	Transistor 2SA 1015Y	DTR119011			
5Q08	Transistor 2SC 982TM	DTR130551			
5Q09	Transistor 2SC 1815GR	DTR139011			
5Q10	Same as 5Q07				
5Q11	Same as 5Q01				
5Q12	Same as 5Q01				
5Q13	Transistor 2SC 2901	DTR135741			
5Q14	Same as 5Q13				
5Q15	Transistor 2SK 30A-Y	DTR210141			
5Q17	Same as 5Q09				
5Q18	Same as 5Q15				
5Q19	Same as 5Q02				
5S01	Switch SLR02	DSW045091			
5S02	Same as 5S01				
5S03	Switch SUJ12A	DSW014831			
5J13	Connector, M36-M85-05	DCN034631			
5J21	Connector, M36-M87-02	DCN034601			
5J32	Same as 5J21				
5J38	Connector, BNC080	DCN040711			
5P13	Connector, M36-05-30-114P	DCN034881			
5P21	Connector, M36-02-30-114P	DCN034851			
5P32	Same as 5P21				

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
HORIZONTAL CONTROL 6			6R32	Res., 10, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939011
6C05	Cap., 1000p, $\pm 10\%$, 50V, Cer.	DCC139051	6R34	Res., 4.7k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939331
6C06	Cap., 150p, $\pm 5\%$, 50V, Cer.	DCC239021	6R35	Same as 6R09	
6C07	Cap., 1p, $\pm 0.25\%$, 50V, Cer.	DCC239191	6R38	Same as 6R34	
6C08	Same as 6C07		6R39	Same as 6R34	
6C09	Cap., 22μ , $\pm 20\%$, 25V, Elect.	DCE229041	6R50	Same as 6R08	
6C10	Cap., 22p, $\pm 20\%$, 25V, Elect.	DCE225151	6R51	Same as 6R08	
6C11	Cap., 0.01μ , $+80\sim -20\%$, 50V, Cer.	DCC139501	6R52	Same as 6R08	
6C12	Same as 6C11		6R53	Same as 6R09	
6C13	Same as 6C11		6RA01	Res., 4.7k, $\pm 10\%$, 0.1W, Carbon	DFB011151
6C14	Same as 6C11		6RA02	Res., 1k, $\pm 10\%$, 0.1W, Carbon	DFB011101
6C21	Same as 6C11		6D01	Diode TLG206	DDD071121
6C22	Same as 6C11		6D02	Diode TLR206	DDD070181
6C23	Same as 6C11		6D03	Diode RD12EB2	DDD032041
6R01	Res., B20k, Var, 0.25W, Carbon	DRV146951	6D04	Diode 1k34A	DDD010101
6R02	Res., 8.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939361	6D05	Same as 6D04	
6R03	Res., 680, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939231	6D06	Same as 6D04	
6R06	Res., 1.0M, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939611	6D10	Same as 6D04	
6R07	Res., 330, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939191	6D11	Same as 6D04	
6R08	Res., 10k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939371	6D13	Diode, 1S953	DDD010821
6R09	Res., 1.0k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939251	6D14	Same as 6D12	
6R10	Res., 12k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939381	6D15	Same as 6D12	
6R11	Res., B1k, Var, 0.3W, Metal	DRV412111	6D16	Same as 6D12	
6R12	Res., 2.7k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939301	6D17	Same as 6D12	
6R13	Res., B2k, Var, 0.3W, Metal	DRV412171	6D18	Same as 6D12	
6R14	Res., B10k, Var, 0.25W, Carbon	DRV147411	6Q01	Transistor, 2SC 1815GR	DTR139011
6R15	Same as 6R13		6Q02	Same as 6Q01	
6R16	Res., 1.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939261	6Q05	Transistor, DTC 114-A	DTR190941
6R17	Same as 6R12		6Q06	Same as 6Q05	
6R18	Res., 1.5k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939271	6Q07	Same as 6Q05	
6R19	Res., 47k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939451	6S01	Switch SUJ35A	DSW014701
6R24	Res., 18k, $\pm 1\%$, 1/5W, Metal	DRE999401	6S02	Switch SUJ45A	DSW014721
6R25	Same as 6R24		6J12	Connector, ZC-120	DCN032781
6R26	Res., 6.8k, $\pm 1\%$, 1/5W, Metal	DRE999351	6J17	Connector, CF-120A	DCN035541
6R27	Res., B5k, Var, 0.3W, Metal	DRV412051	6IC01	IC, SN74LS10N	DIC140111
6R28	Res., B1k, Var, 0.3W, Metal	DRV412031	6IC02	IC, SN 7406N	DIC110071
6R29	Res., 3.6k, $\pm 1\%$, 1/5W, Metal	DRE999551			
6R30	Res., 5.6k, $\pm 1\%$, 1/5W, Metal	DRE999341			
6R31	Same as 6R30				

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
6IC03	IC, SN 74LS00N	DIC140011			
6IC04	IC, SN 74LS112N	DIC141111			
6FL-2	SMCD-20-100-AD-20-P1.25	KHB058411			

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
A SWEEP GENERATOR 7			7R17	Same as 7R13	
7C01	Cap., 0.01 μ , +80~—20%, 50V, Cer.	DCC139501	7R18	Same as 7R13	
7C03	Same as 7C01		7R19	Res., 390, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939201
7C04	Cap., 120p, $\pm 5\%$, 50V, Cer.	DCC239261	7R20	Res., 3.9k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939321
7C07	Cap., 15p, $\pm 5\%$, 50V, Cer.	DCC239221	7R21	Same as 7R19	
7C08	Cap., 68p, $\pm 5\%$, 50V, Cer.	DCC239311	7R22	Same as 7R14	
7C09	Cap., 2.5~22.5p, Var, 250V, Cer.	DCV019592	7R23	Same as 7R14	
7C10	Cap., 47, $\pm 5\%$, 100V, Cer.	DCC249511	7R24	Same as 7R16	
7C12	Same as 7C01		7R25	Res., B1k, Var, 0.3W, Metal	DRV412031
7C13	Cap., 100p, $\pm 5\%$, 50V, Cer.	DCC239051	7R26	Res., 1.5k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939271
7C14	Cap., 180p, $\pm 5\%$, 50V, Cer.	DCC239271	7R28	Res., B500k, Var, 0.25W, Carbon	DRV146141
7C15	Same as 7C01		7R29	Res., 10k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939371
7C16	Same as 7C13		7R32	Res., 56k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939461
7C17	Same as 7C01		7R33	Same as 7R20	
7C18	Cap., 1500p, $\pm 10\%$, 50V, Film	DCF129011	7R34	Res., 10, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939011
7C19	Cap., 2.2p, Var, 50V, Elect.	DCE245031	7R37	Same as 7R29	
7C20	Same as 7C01		7R38	Res., 4.7k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939331
7C21	Cap., 22p, $\pm 20\%$, 25V, Elect.	DCE225151	7D01	Diode 1S953	DDD010821
7C22	Same as 7C01		7D02	Diode 1SS97	DDD010451
7C23	Same as 7C01		7D03	Diode RD5.6EB2	DDD032021
7C25	Same as 7C01		7D04	Diode RD24EB	DDD032281
7C26	Cap., 22p, $\pm 20\%$, 25V, Elect.	DCE229041	7D05	Same as 7D01	
7C28	Same as 7C26		7D06	Diode 1k34A	DDD010101
7C29	Same as 7C01		7D07	Same as 7D06	
7C30	Cap., 10p, $\pm 0.5\%$, 50V, Cer.	DCC239041	7D08	Same as 7D06	
7C31	Cap., 150p, $\pm 5\%$, 50V, Cer.	DCC239021	7Q01	Transistor 2SA1206	DTR115301
7C32	Same as 7C31		7Q02	Same as 7Q01	
7R01	Res., 220, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939171	7Q03	Transistor 2SC2901	DTR135741
7R02	Res., 1.0k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939251	7Q04	Same as 7Q03	
7R03	Res., 680, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939231	7Q05	Transistor 2SK 30A-Y	DTR210141
7R04	Res., 180, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939161	7Q06	Same as 7Q01	
7R05	Same as 7R04		7Q07	Same as 7Q05	
7R06	Same as 7R03		7Q08	Transistor 2SC 1815GR	DTR139011
7R11	Res., 2.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939291	7Q09	Transistor 2SA 1015Y	DTR119011
7R12	Same as 7R11		7Q10	Same as 7Q08	
7R13	Res., 22k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939411	7Q11	Same as 7Q09	
7R14	Res., 100, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939131	7IC01	IC, F10107DC	DIC310051
7R15	Res., 15k, $\pm 1\%$, $\frac{1}{4}W$, Metal	DRE939341	7IC02	IC, SN74LS123N	DIC141181
7R16	Res., 15k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939391	7IC03	IC, SN74LS112N	DIC170511

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
7IC04	IC, SN74LS14N	DIC140151			
7J15	Connector, M36-M87-05	DCN034631			
7P17	Connector, M36-05-30-114P	DCN034881			
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CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
B SWEEP GENERATOR 8			8R23	Res., 1.5k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939271
8C01	Cap., 0.01 μ , +80 $\sim$ -20%, 50V, Cer.	DCC139501	8R24	Same as 8R07	
8C02	Cap., 22 μ , $\pm 20\%$, 25V, Elect.	DCE229041	8R25	Res., 1.0k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939251
8C03	Same as 8C02		8R26	Same as 8R23	
8C08	Cap., 100p, $\pm 5\%$, 50V, Cer.	DCC239051	8R27	Same as 8R11	
8C09	Cap., 15p, $\pm 5\%$, 50V, Cer.	DCC239221	8R28	Same as 8R18	
8C10	Cap., 68p, $\pm 5\%$, 50V, Cer.	DCC239311	8D01	Diode, RD3.9EB1	DDD032871
8C11	Cap., 2.5 $\sim$ 22.5p, Var, 250V, Cer.	DCV019592	8D02	Diode, 1S953	DDD010821
8C12	Cap., 47p, $\pm 5\%$, 100V, Cer.	DCC249511	8D03	Diode, 1SS97	DDD010451
8C14	Same as 8C01		8D04	Diode, RD5.6EB2	DDD032021
8C15	Same as 8C08		8D05	Diode, RD24EB	DDD032281
8C16	Cap., 180p, $\pm 5\%$, 50V, Cer.	DCC239271	8D06	Same as 8D02	
8C17	Same as 8C01		8Q01	Transistor, 2SC1815GR	DTR139011
8C18	Same as 8C01		8Q02	Same as 8Q01	
8C19	Same as 8C08		8Q03	Transistor, 2SC2901	DTR135741
8C20	Same as 8C01		8Q04	Same as 8Q03	
8C21	Cap., 22p, $\pm 5\%$, 50V, Cer.	DCC239121	8Q05	Transistor, 2SK30A-Y	DTR210141
8R01	Res., 8.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939361	8Q06	Transistor, 2SA1206	DTR115301
8R02	Res., 10k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939371	8Q07	Same as 8Q05	
8R03	Same as 8R02		8Q08	Same as 8Q01	
8R04	Same as 8R02		8Q09	Transistor, 2SA1015Y	DTR119011
8R05	Res., 15k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939391	8Q10	Same as 8Q01	
8R06	Res., 3.9k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939321	8IC01	IC, SN74LS10N	DIC140111
8R07	Res., 4.7k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939331	8IC02	IC, SN74LS112N	DIC141111
8R08	Res., 220, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939171	8IC03	IC, TL810CP	DIC630731
8R09	Res., 2.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939291	8IC04	IC, SN74LS04N	DIC140051
8R10	Same as 8R09		8J14	Connector, M36-M87-03	DCN034611
8R11	Res., 22k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939411	8P14	Connector, M36-03-30-114P	DCN034861
8R12	Res., 100, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939131			
8R13	Res., 15k, $\pm 1\%$, $\frac{1}{4}W$, Metal	DRE939341			
8R14	Same as 8R11				
8R15	Same as 8R05				
8R16	Same as 8R08				
8R17	Res., B500, Var, 0.3W, Metal	DRV412021			
8R18	Res., 3.3k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939311			
8R19	Res., 390, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939201			
8R20	Same as 8R12				
8R21	Same as 8R12				
8R22	Res., 12k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939381			

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
A TIMING 9			9R26	Res., 10, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939011
			9R27	Same as 9R21	
9C01	Cap., 0.01 μ , $+80 \sim -20\%$, 50V, Cer.	DCC139501	9R28	Same as 9R20	
			9R29	Same as 9R20	
9C02	Cap., 1 μ , $\pm 20\%$, 50V, Elect.	DCE249121	9R30	Res., 2.2M, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD139831
9C04	Cap., 0.47 μ , $\pm 20\%$, 50V, Elect.	DCE249111	9RA01	Res., 47k, $\pm 5\%$, 1/8W, Carbon	DFB016271
9C05	Cap., 0.001 μ , $\pm 10\%$, 50V, Film	DCF129131	9RA02	Res., 10k, $\pm 5\%$, 1/8W, Carbon	DFB015541
9C06	Cap., 0.015 μ , $\pm 10\%$, 50V, Film	DCF129031	9RA03	Res., 39k, $\pm 5\%$, 1/8W, Carbon	DFB017641
9C07	Cap., 0.15 μ , $\pm 10\%$, 50V, Film	DCF129011	9RA04	Res., 120k, $\pm 5\%$, 1/8W, Carbon	DFB017631
9C09	Cap., 0.01 μ , $\pm 0.25\%$, 50V, Film	DCF125771			
9C10	Cap., 1 μ , $\pm 1\%$, 50V, Film	DCF420281	9D01	Diode, 1S953	DDD010821
9C11	Cap., 4700p, $\pm 10\%$, 50V, Film	DCF129081	9D02	Same as 9D01	
9C12	Cap., 0.01 μ , $\pm 10\%$, 500V, Cer.	DCC153561	9D03	Same as 9D01	
9C13	Same as 9C01		9D04	Diode, TLR206	DDD070181
9C14	Same as 9C01				
9C15	Same as 9C01		9Q01	Transistor, 2SC1815GR	DTR139011
9C16	Same as 9C01		9Q02	Same as 9Q01	
			9Q03	Transistor, 2SA992F	DTR115561
9R01	Res., 56k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939461	9Q04	Same as 9Q03	
9R02	Same as 9R01		9Q05	Same as 9Q03	
9R03	Same as 9R01		9Q06	Same as 9Q03	
9R04	Same as 9R01		9Q07	Same as 9Q03	
9R05	Same as 9R01		9Q08	Same as 9Q03	
9R06	Same as 9R01		9Q09	Same as 9Q03	
9R07	Same as 9R01		9Q10	Same as 9Q03	
9R08	Same as 9R01		9Q11	Same as 9Q03	
9R09	Same as 9R01		9Q12	Transistor, 2N3905	DTR150011
9R10	Res., 50k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938041			
9R11	Res., 20k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938321	9IC01	IC, SN74LS42N	DIC140431
9R12	Res., 10k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938301	9IC02	IC, SN7407N	DIC110081
9R13	Res., 500k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938071	9IC03	IC, SN75451BP	DIC195011
9R14	Res., 200k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938351	9IC04	IC, SN74LS03N	DIC140041
9R15	Res., 100k, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938331	9IC05	IC, SN7445N	DIC110461
9R16	Res., 5M, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE948051			
9R17	Res., 2M, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938381	9RL01	Relay, MZ-12HS	DKD026501
9R18	Res., 1M, $\pm 0.5\%$, $\frac{1}{4}W$, Metal	DRE938371	9RL02	Same as 9RL01	
9R19	Res., 220, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939171			
9R20	Res., 100k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939491	9S01	Switch, BCM2401	DSW033421
9R21	Res., 15k, $\pm 1\%$, 1/5W, Metal	DRE999391			
9R22	Res., 5.6k, $\pm 1\%$, 1/5W, Metal	DRE999341	9P34	Connector, M36-03-30-114P	DCN034861
9R23	Res., 2.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939291			
9R24	Res., B100k, Var, 0.1W, Carbon	DRV147431	9J34	Connector, M36-M87-03	DCN034611

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
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12C02	Cap., 0.01 μ , +80~-20%, 50V, Cer.	DCC139511
12C03	Cap., 0.22 μ , $\pm$ 10%, 50V, Film	DCF129711
12C04	Cap., 22p, $\pm$ 5%, 50V, Cer.	DCC239121
12C05	Cap., 0.01 μ , +80~-20%, 3000V, Cer.	DCC173501
12C06	Cap., 4700p, $\pm$ 10%, 500V, Cer.	DCC152901
12C08	Cap., 0.022 μ , $\pm$ 10%, 200V, Film	DCF150271
12C09	Cap., 1000p, $\pm$ 10%, 500V, Cer.	DCC159011
12C10	Same as 12C05	
12C11	Same as 12C05	
12C12	Cap., 1000p, $\pm$ 20%, 3000V, Cer.	DCC171831
12C13	Same as 12C05	
12C14	Same as 12C05	
12C15	Same as 12C12	
12C16	Cap., 0.01 μ , $\pm$ 10%, 500V, Cer.	DCC153561
12C17	Same as 12C09	
12C18	Cap., 15p, $\pm$ 5%, 50V, Cer.	DCC239221
12C19	Same as 12C18	
12C22	Cap., 22 μ , $\pm$ 20%, 25V, Elect.	DCE229041
12C23	Same as 12C22	
12C24	Same as 12C18	
12C25	Same as 12C03	
12C30	Cap., 0.5p, $\pm$ 0.25%, 500V, Cer.	DCC250101
12R01	Res., 1.0k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939251
12R02	Res., 1.2k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939261
12R03	Res., 5.6k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939341
12R04	Same as 12R01	
12R05	Res., 33k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939431
12R06	Res., 680, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939231
12R07	Res., 100k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939491
12R08	Res., 6.8k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939351
12R09	Res., 1.8k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939281
12R10	Res., 2.2k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939291
12R11	Res., 10k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939371
12R12	Res., 560, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939221
12R13	Same as 12R12	
12R14	Same as 12R07	
12R15	Res., 2.2k, $\pm$ 1%, 1/5W, Metal	DRE999291

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
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12R16	Res., 22k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939411
12R17	Same as 12R15	
12R18	Res., B22k, Var, 0.5W, Metal	DRV430701
12R19	Res., 47k, $\pm$ 1%, 1/5W, Metal	DRE999451
12R20	Res., 330, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939191
12R22	Res., 18k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939401
12R23	Res., 220k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939531
12R24	Same as 12R02	
12R25	Res., 1M, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD135551
12R26	Res., 3.3k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939311
12R27	Res., 1.2k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939261
12R28	Res., 56k., $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939461
12R29	Same as 12R07	
12R30	Res., 180, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD139961
12R31	Res., Blook, Var, 0.5W, Metal	DRV430631
12R32	Res., 47k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939451
12R33	Same as 12R22	
12R34	Res., 12, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD139971
12R35	Res., 150, $\pm$ 5%, 1W, Metal	DRS229231
12R36	Same as 12R22	
12R37	Res., B220k, Var, 0.5W, Metal	DRV430611
12R38	Res., 22M, $\pm$ 5%, $\frac{1}{2}$ W, Metal	DRG940341
12R39	Res., 100k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD135311
12R40	Res., B50k, Var, 0.25W, Carbon	DRV146961
12R41	Res., 2.2M, $\pm$ 5%, $\frac{1}{2}$ W, Metal	DRG940311
12R42	Res., 15M, $\pm$ 5%, $\frac{1}{2}$ W, Metal	DRF950121
12R43	Res., B2M, Var, 1W, Metal	DRV350231
12R44	Res., 10k, $\pm$ 5%, 1W, Metal	DRS229361
12R45	Same as 12R09	
12R46	Res., 100, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939131
12R47	Same as 12R28	
12R48	Res., B10k, Var, 0.25W, Carbon	DRV146971
12R49	Same as 12R10	
12R50	Res., 22k, $\pm$ 1%, $\frac{1}{4}$ W, Metal	DRE939061
12R51	Res., 27k, $\pm$ 1%, $\frac{1}{4}$ W, Metal	DRE939361
12R52	Same as 12R05	
12R61	Same as 12R32	
12RA01	Res., 10k, $\pm$ 10%, Metal	DFB011181
12D01	Diode, 1S953	DDD010821
12D02	Same as 12D01	

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
HORIZONTAL AMPLIFIER 11			11R24	Same as 11R23	
11C01	Cap., 22 μ , $\pm$ 20%, 25V, Metal	DCE229041	11R25	Res., 4.7k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939331
11C02	Same as 11C01		11R26	Same as 11R10	
11C03	Same as 11C01		11R28	Res., 30k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939681
11C04	Same as 11C01		11R31	Res., 1.0k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939251
11C05	Cap., 0.01 μ , $\pm$ 10%, 500V, Carbon	DCC153561	11R32	Res., 470, $\pm$ 1%, 1/5W, Metal	DRE999211
11C06	Same as 11C05		11R33	Same as 11R32	
11C07	Cap., 0.01 μ , +80 $\sim$ -20%, 50V, Carbon	DCC139501	11R34	Res., B500, Var, 0.3W, Carbon	DRV412021
11C08	Same as 11C01		11R35	Same as 11R23	
11C09	Same as 11C07		11R36	Res., 3.9k, $\pm$ 1%, 1/5W, Metal	DRE999321
11C12	Same as 11C07		11R37	Same as 11R34	
11C13	Same as 11C07		11R38	Same as 11R36	DRE999321
11C14	Cap., 24p, $\pm$ 5%, 50V, Carbon	DCC239231	11R39	Res., 100, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939131
11C15	Same as 11C07		11R40	Res., 1.8k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939281
11C16	Cap., 0.047 μ , $\pm$ 20%, 250V, Film	DCF160291	11R41	Res., 56k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939461
11C17	Same as 11C16		11R42	Res., 2.7k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939301
11C18	Same as 11C16		11R43	Res., 470, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939211
11C19	Same as 11C16		11R44	Res., 47k, $\pm$ 1%, $\frac{1}{2}$ W, Metal	DRE141231
11C20	Cap., 0.5p, $\pm$ 0.25%, 500V, Cer.	DCC250101	11R45	Res., 47, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939091
11C21	Same as 11C20		11R46	Res., 22k, $\pm$ 1%, 1/5W, Metal	DRE939061
11R01	Res., 10, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939011	11R47	Same as 11R46	
11R02	Same as 11R01		11R48	Same as 11R39	
11R03	Res., 3.9k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939321	11R49	Same as 11R40	
11R05	Res., 15k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939391	11R50	Same as 11R41	
11R06	Res., 10k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939371	11R51	Same as 11R42	
11R07	Res., 3.3k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939311	11R52	Same as 11R43	
11R08	Res., 6.8k, $\pm$ 1%, 1/5W, Metal	DRE999351	11R53	Same as 11R44	
11R09	Same as 11R08		11R54	Same as 11R45	
11R10	Res., 22k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939411	11R55	Same as 11R46	
11R11	Same as 11R10		11R56	Same as 11R46	
11R12	Same as 11R10		11R58	Res., B20k, Var, 0.25W, Carbon	DRV146951
11R13	Same as 11R10		11D01	Diode 1S953	DDD010821
11R14	Res., 47k, $\pm$ 5%, $\frac{1}{4}$ W, Carbon	DRD939451	11D02	Same as 11D01	
11R15	Res., B500, Var, 0.3W, Carbon	DRV412021	11D03	Diode RD5.1EB2	DDD032071
11R18	Res., 270, $\pm$ 1%, 1/5W, Metal	DRE999181	11D04	Diode DA203	DDD991111
11R19	Res., B1k, Var, 0.3W, Carbon	DRV412031	11Q01	Transistor 2SC1815GR	DTR139011
11R20	Res., 2.2k, $\pm$ 1%, 1/5W, Metal	DRE999291	11Q02	Same as 11Q01	
11R21	Res., 4.7k, $\pm$ 1%, 1/5W, Metal	DRE999331	11Q03	Same as 11Q01	
11R22	Same as 11R21		11Q05	Transistor 2SA1206	DTR115301
11R23	Res., 270, $\pm$ 1%, 1/5W, Metal	DRE999181	11Q06	Same as 11Q05	

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
11Q07	Transistor 2SA1015Y	DTR119011			
11Q08	Same as 11Q01				
11Q09	Same as 11Q01				
11Q10	Transistor 2SC1907	DTR137611			
11Q11	Same as 11Q10				
11Q12	Transistor 2SC1904G/B	DTR137051			
11Q13	Same as 11Q12				
11Q14	Transistor 2SA899G/B	DTR115691			
11Q15	Same as 11Q14				
11RL01	Relay MZ-12HS	DKD026501			

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
Z AXIS & CRT CIRCUIT 12			12R16	Res., 22k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939411
12C02	Cap., 0.01 μ , +80 $\sim$ -20%, 50V, Cer.	DCC139511	12R17	Same as 12R15	DRV430701
12C03	Cap., 0.22 μ , $\pm 10\%$, 50V, Film	DCF129711	12R18	Res., B22k, Var, 0.5W, Metal	DRE999451
12C04	Cap., 22p, $\pm 5\%$, 50V, Cer.	DCC239121	12R19	Res., 47k, $\pm 1\%$, $\frac{1}{5}W$, Metal	DRD939191
12C05	Cap., 0.01 μ , +80 $\sim$ -20%, 3000V, Cer.	DCC173501	12R20	Res., 330, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939401
12C06	Cap., 4700p, $\pm 10\%$, 500V, Cer.	DCC152901	12R22	Res., 18k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939531
12C08	Cap., 0.022 μ , $\pm 10\%$, 200V, Film	DCF150271	12R23	Res., 220k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD135551
12C09	Cap., 1000p, $\pm 10\%$, 500V, Cer.	DCC159011	12R24	Same as 12R02	DRD939311
12C10	Same as 12C05		12R25	Res., 1M, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939261
12C11	Same as 12C05		12R26	Res., 3.3k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939461
12C12	Cap., 1000p, $\pm 20\%$, 3000V, Cer.	DCC171831	12R27	Res., 1.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	
12C13	Same as 12C05		12R28	Res., 56k., $\pm 5\%$, $\frac{1}{4}W$, Carbon	
12C14	Same as 12C05		12R29	Same as 12R07	
12C15	Same as 12C12		12R30	Res., 180, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD139961
12C16	Cap., 0.01 μ , $\pm 10\%$, 500V, Cer.	DCC153561	12R31	Res., Blook, Var, 0.5W, Metal	DRV430631
12C17	Same as 12C09		12R32	Res., 47k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939451
12C18	Cap., 15p, $\pm 5\%$, 50V, Cer.	DCC239221	12R33	Same as 12R22	
12C19	Same as 12C18		12R34	Res., 12, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD139971
12C22	Cap., 22 μ , $\pm 20\%$, 25V, Elect.	DCE229041	12R35	Res., 150, $\pm 5\%$, 1W, Metal	DRS229231
12C23	Same as 12C22		12R36	Same as 12R22	
12C24	Same as 12C18		12R37	Res., B220k, Var, 0.5W, Metal	DRV430611
12C25	Same as 12C03		12R38	Res., 22M, $\pm 5\%$, $\frac{1}{2}W$, Metal	DRG940341
12C30	Cap., 0.5p, $\pm 0.25\%$, 500V, Cer.	DCC250101	12R39	Res., 100k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD135311
12R01	Res., 1.0k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939251	12R40	Res., B50k, Var, 0.25W, Carbon	DRV146961
12R02	Res., 1.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939261	12R41	Res., 2.2M, $\pm 5\%$, $\frac{1}{2}W$, Metal	DRG940311
12R03	Res., 5.6k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939341	12R42	Res., 15M, $\pm 5\%$, $\frac{1}{2}W$, Metal	DRF950121
12R04	Same as 12R01		12R43	Res., B2M, Var, 1W, Metal	DRV350231
12R05	Res., 33k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939431	12R44	Res., 10k, $\pm 5\%$, 1W, Metal	DRS229361
12R06	Res., 680, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939231	12R45	Same as 12R09	
12R07	Res., 100k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939491	12R46	Res., 100, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939131
12R08	Res., 6.8k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939351	12R47	Same as 12R28	
12R09	Res., 1.8k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939281	12R48	Res., B10k, Var, 0.25W, Carbon	DRV146971
12R10	Res., 2.2k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939291	12R49	Same as 12R10	
12R11	Res., 10k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939371	12R50	Res., 22k, $\pm 1\%$, $\frac{1}{4}W$, Metal	DRE939061
12R12	Res., 560, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939221	12R51	Res., 27k, $\pm 1\%$, $\frac{1}{4}W$, Metal	DRE939361
12R13	Same as 12R12		12R52	Same as 12R05	
12R14	Same as 12R07		12R61	Same as 12R32	
12R15	Res., 2.2k, $\pm 1\%$, $\frac{1}{5}W$, Metal	DRE999291	12RA01	Res., 10k, $\pm 10\%$, Metal	DFB011181
			12D01	Diode, 1S953	DDD010821
			12D02	Same as 12D01	

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
12D03	Same as 12D01		12P04	Connector, M36-02-30-114P	DCN034851
12D04	Same as 12D01		12P05	Same as 12P04	
12D05	Same as 12D01		12P30	Connector, M36-04-30-114P	DCN034871
12D06	Same as 12D01				
12D07	Same as 12D01		12V01	CRT E2907B31	DET014131
12D09	Same as 12D01				
12D10	Same as 12D01		12SK1	Socket of CRT S-B0864	DSK010291
12D11	Same as 12D01				
12D12	Diode, RD5.6EB1	DDD031141	12NE1	Lamp NL-235D	DLP025171
12D13	Diode, ESJA35-12	DDD022111			
12D14	Same as 12D13		12M01	High voltage unit MR4A-12F	DES050601
12D15	Same as 12D13				
12D16	Diode RD30EB	DDD031681	12L01	Rotation coil	DCL140341
12D17	Same as 12D13				
12D18	Same as 12D13		12T01	High voltage transformer HVT-3D3616	DCL220371
12D19	Same as 12D13				
12D20	Diode, 1S953	DDD010821			
12D21	Same as 12D20				
12D22	Same as 12D20				
12D23	Diode, RD12EB	DDD031791			
12Q01	Transistor 2SA1015Y	DTR119011			
12Q02	Transistor 2SC1815GR	DTR139011			
12Q03	Transistor 2SC2502	DTR137651			
12Q04	Same as 12Q02				
12Q05	Same as 12Q02				
12Q06	Transistor 2SD668AC	DTR145381			
12Q07	Same as 12Q01				
12Q08	Transistor 2SB648AC	DTR125191			
12IC01	IC, NJM 4558D	DIC613031			
12J02	Connector, M31-M87-10	DCN034531			
12J03	Connector, M36-M87-03	DCN034611			
12J04	Connector, M36-M87-02	DCN034601			
12J05	Connector, M36-M87-02	DCN034601			
12J22	Connector, ZC-116	DCN032761			
12J30	Connector, M36-M87-04	DCN034621			
12J39	Connector, BNC080	DCN040711			
12P02	Connector, M33-10-30-114P	DCN034721			
12P03	Connector, M36-03-30-114P	DCN034861			

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
POWER SUPPLY 13			13R19	Res., 3.3, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939771
13C01	Cap., 2200 μ , $\pm 20\%$, 25V, Elect.	DCE225231	13R20	Res., 100k, $\pm 1\%$, 1/5W, Metal	DRE999491
13C02	Same as 13C01		13R21	Same as 13R14	
13C03	Cap., 470 μ , $\pm 20\%$, 100V, Elect.	DCE255131	13R22	Res., 10k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939371
13C04	Same as 13C03		13R23	Res., 150, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939151
13C05	Cap., 4700 μ , $\pm 20\%$, 16V, Elect.	DCE225111	13R24	Res., 330, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939191
13C06	Cap., 22 μ , $\pm 20\%$, 25V, Elect.	DCE229041	13R25	Res., 120k, $\pm 1\%$, $\frac{1}{4}W$, Metal	DRE939971
13C07	Cap., 100 μ , $\pm 20\%$, 25V, Elect.	DCE229071	13R26	Same as 13R14	
13C08	Same as 13C07		13R28	Res., 4.7, $\pm 5\%$, 2W, Metal	DRS231121
13C09	Cap., 10 μ , $\pm 20\%$, 160V, Elect.	DCE260501	13R30	Same as 13R17	
13C10	Cap., 10 μ , $\pm 20\%$, 160V, Elect.	DCE160501	13R31	Same as 13R20	
13C11	Same as 13C07		13R33	Res., 1.5k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939271
13C12	Cap., 47 μ , $\pm 20\%$, 10V, Elect.	DCE215301	13R35	Res., 2.2M, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD139831
13C30	Cap., 0.01 μ , +80 $\sim$ -20%, 50V, Cer.		13R36	Same as 13R09	
		DCC139501	13R37	Same as 13R22	
13C31	Same as 13C30		13R50	Res., B1k, Var, 0.5W, Metal	DRV430571
13C32	Cap., 0.01 μ , $\pm 10\%$, 50V, Film	DCF129051	13R51	Res., 50, Var, 1W, Metal	DRV350202
13C33	Cap., 0.047 μ , $\pm 10\%$, 50V, Film	DCF129581			
13C34	Same as 13C06		13D01	Diode, 1B4B1	DDD021011
13C35	Same as 13C30		13D02	Diode, 1D4B1	DDD021021
13C36	Cap., 0.01 μ , +80 $\sim$ -20%, 50V, Cer.		13D03	Same as 13D02	
		DCC133571	13D04	Same as 13D01	
13C37	Cap., 0.022 μ , $\pm 10\%$, 200V, Film	DCF150271	13D05	Diode, RD8.2EB1	DDD030881
			13D06	Diode, RD5.1EB2	DDD032071
13R01	Res., 47k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939451	13D07	Same as 13D05	
13R02	Same as 13R01		13D08	Diode, RD24EB	DDD032281
13R04	Res., 220k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939531	13D09	Same as 13D08	
13R05	Res., 22k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939411	13D10	Same as 13D08	
13R06	Res., 470, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939211	13D11	Same as 13D08	
13R07	Res., 2.7, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939761	13D12	Diode, 1S953	DDD010821
13R08	Same as 13R07		13D13	Same as 13D12	
13R09	Res., 1.0k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939251	13D14	Same as 13D12	
13R10	Res., 4.7k, $\pm 1\%$, 1/5W, Metal	DRE999331	13D15	Diode, V06E	DDD020091
13R11	Same as 13R10		13D16	Diode, TLG143	DDD071821
13R12	Same as 13R07		13D17	Same as 13D15	
13R13	Same as 13R07				
13R14	Res., 10k, $\pm 1\%$, 1/5W, Metal	DRE999371	13Q01	Transistor, 2SK30A-Y	DTR210141
13R15	Same as 13R14		13Q02	Transistor, 2SA1015Y	DTR119011
13R16	Res., 4.7k, $\pm 5\%$, $\frac{1}{4}W$, Carbon	DRD939331	13Q03	Same as 13Q02	
13R17	Res., 10k, $\pm 5\%$, 1W, Metal	DRS229361	13Q04	Transistor, 2SB941P/Q	DTR125451
13R18	Same as 13R17		13Q05	Transistor, 2SD1266P/Q	DTR145851
			13Q06	Transistor, 2SC1815GR	DTR139011

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
13Q07	Transistor, 2SD1137	DTR145711			
13Q08	Same as 13Q06				
13Q09	Transistor, 2SB861C	DTR125181			
13IC01	IC, NJM4558D	DIC613031			
13IC02	IC, μ PC251C	DIC610091			
13IC03	IC, μ PC14305H	DIC650021			
13S01	Switch, SDG5P-E	DSW016531			
13J01	Connector, M31-M87-10	DCN034531			
13J02	Power voltage selector socket, S-17220#04	DCN093521			
13J08	Connector, 5124-15BHPB	DCN990631			
13J09	Same as 13J08				
13J10	Connector, ZC-116	DCN032761			
13J23	Connector, M36-M87-06	DCN034641			
13J31	Connector, M31-M87-12	DCN034541			
13P01	Connector, M33-10-30-114P	DCN034721			
13P01A	Inlet, CM-3	DCN013361			
13P02	Power voltage selector plug, X-17213	DCN093511			
13P08	Connector, 5243-15C	DCN991161			
13P09	Same as 13P08				
13P23	Connector, M36-06-30-114P	DCN034891			
13P31	Connector, M33-12-30-114P	DCN034731			
13T01	Power transformer, FS-35321-2	DCL213151			
13TB01	Ground terminal, B(8 ϕ)	DTA020501			
13F01	Fuse, FSA-1	DFU020141			
13F02	Fuse, FSA-2	DFU020141			
PL01	Lamp, BQ064-22012A	DLP016092			
PL02	Same as PL01				
PL03	Same as PL01				
FL01	SMCD-16-50-AD-10-P1.25	KHB058311			

CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.	CIRCUIT REFERENCE	DESCRIPTION	IWATSU PART No.
PRINTED CIRCUIT BOARDS					
14PB01	V-BOARD	KPN207941			
14PB02	H-BOARD	KPN208031			
14PB03	MAIN BOARD	KPN208121			
14PB04	MIX BOARD	KPN208221			
14PB05	CRT SOCKET BOARD	KPN177531			

NOTES _____

Mechanical Parts List and Illustrations

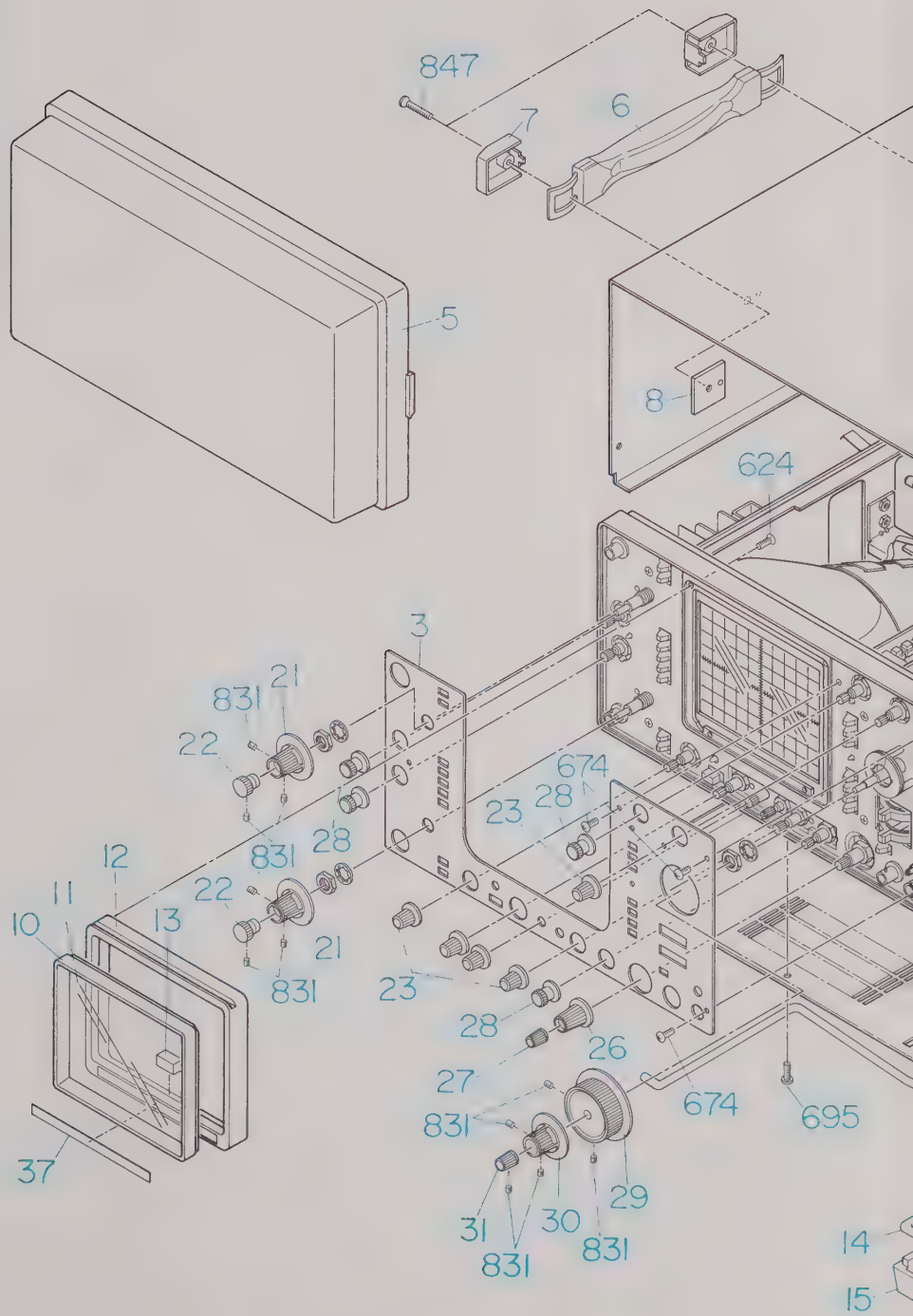
INDEX NO	NAME & DESCRIPTION	Q'ty	IWATSU PART NO
1	COVER, upper	1	KBA547011
2	COVER, lower	1	KBA547121
3	PANEL, front print	1	KPA161211
4	PANEL, rear	1	KCM073511
5	COVER, panel (option)	1	KCM073711
6	HANDLE, A	1	ACM001211
7	HANDLE, fixed	2	KBA059451
8	SEAT PLATE, screw	2	KBA059831
10	FILTER, frame	1	KCM060411
11	FILTER BOARD B	1	KPL014811
12	BEZEL	1	KCM060411
13	STOPPER, filter		KPL013411
14	STAND	1	KMM209711
15	FOOT, E	4	KCM057421
16	FOOT, rubber	4	AGM001311
17	STOPPER for FOOT, 6.2φ	4	ACM001311
20	KNOB, LS	2	KCM073811
21	KNOB, A301760 DGC	2	KCM073131
22	KNOB, N111230 SRP	2	KCM060911
23	KNOB, K141360SG	5	KCM061411
24	KNOB, S181580 DGA	1	KCM074011
25	KNOB, N111230 SWP	1	KCM066211
26	KNOB, S181580 DGC	1	KCM074011
27	KNOB, K101160 SW	1	KCM061111
28	KNOB, K141360 SGP	4	KCM061511
29	KNOB, A471560 DGC	1	KCM072911
30	KNOB, A301540 DGC	1	KCM073021
31	KNOB, N101220 SR	1	KCM060811
32	PS knob D1	12	KCM062011
33	PS knob D2	5	KCM062111
34	PS knob C1	1	KCM061911
35	TIMING PANEL support B	1	KCM061811
36	TIMING PANEL	1	KPA158511
37	NAME PLATE, title	1	KRA117411
38	NAME PLATE, B serial number	1	ARA002711
39	NAME PLATE, line voltage range	1	KRA103931

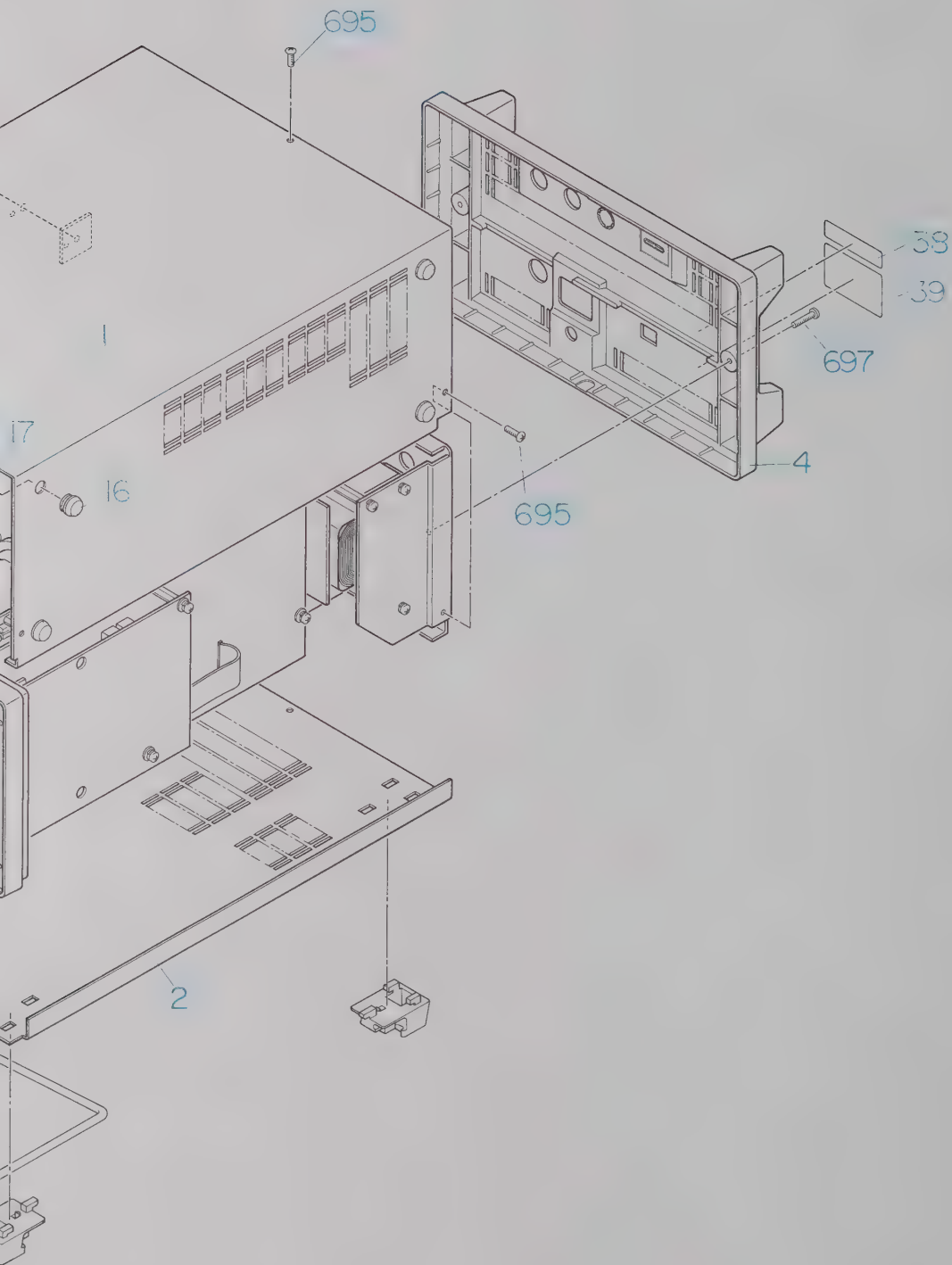
Figure 7-2

INDEX NO	NAME & DESCRIPTION	Q'ty	IWATSU PART NO
20	LEVER of switch	2	KCM073811
32	PS BUTTON D1	12	KCM062011
33	PS BUTTON D2	5	KCM062111
34	PS BUTTON C1	1	KCM061911
35	TIMING PANEL SUPPORT	1	KCM061811
36	TIMING PANEL	1	KPA158511
51	SUB-PANEL, front	1	KPA153211
52	SUB-PANEL, rear	1	KPA159311
53	CHASSIS, left	(1)	KBA546911
54	CHASSIS, right	(1)	KBA546811
55	CRT FIXED BOARD A	1	KBA547221
56	CRT FIXED BOARD B	1	KBA547311
57	CRT FIXED RUBBER41	2	KGM011111
61	EARTH BOARD	1	KBA548011
62	SHIELDED PLATE A	1	KBA548221
63	SHIELDED PLATE B	2	KBA548321
64	SHIELDED PLATE C	1	KBA548411
65	SPRING A, ground	2	KBA547621
66	SPRING B, ground	2	KBA547721
67	HEAT DISSIPATER	2	KBA547511
70	STOPPER, transistor	2	KBA516411
72	REINFORCING PLATE	1	KBA555411
73	SEAT PLATE, inlet	1	KBA526511
74	SEAT PLATE	1	KBA526611
75	SEAT PLATE, transformer	1	KBA516721
76	SHIELDED COVER, ELEC, high voltage	1	KBA547421
77	EXTENSION SHAFT, POWER switch	1	KCM065211
78	EXTENSION SHAFT, FOCUS control	1	KCM073921
100	BAND, CV-100	4	MHK000461
101	STAY, hexagonal	2	KMM209511
		1	KMM209911
		9	KMM197611
104	STAY, SBH (5.5) 4730B0	1	KMM209611
105	STAY, SBH (5.5) 1930B0	2	KMM159411
106	STAY, SBH (5.5) 1030B0	2	AMM474011
111	TERMINAL, CAL	1	DTA010871
		2	KPS004311
113	LUG, both end, 70 m/m	2	KPS009711
114	LUG, both end, 100 m/m	2	KPS009811

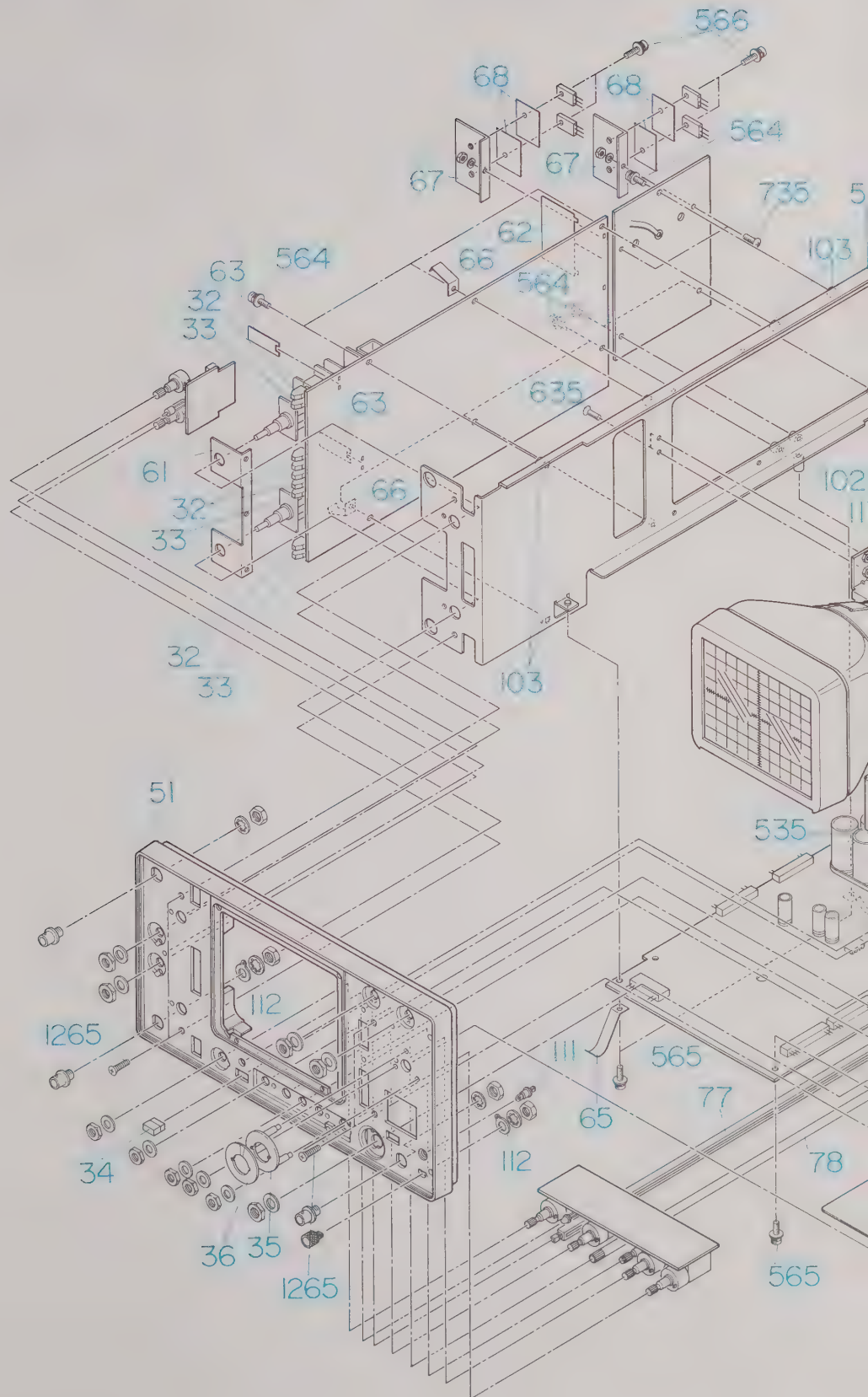
Figure 7-1

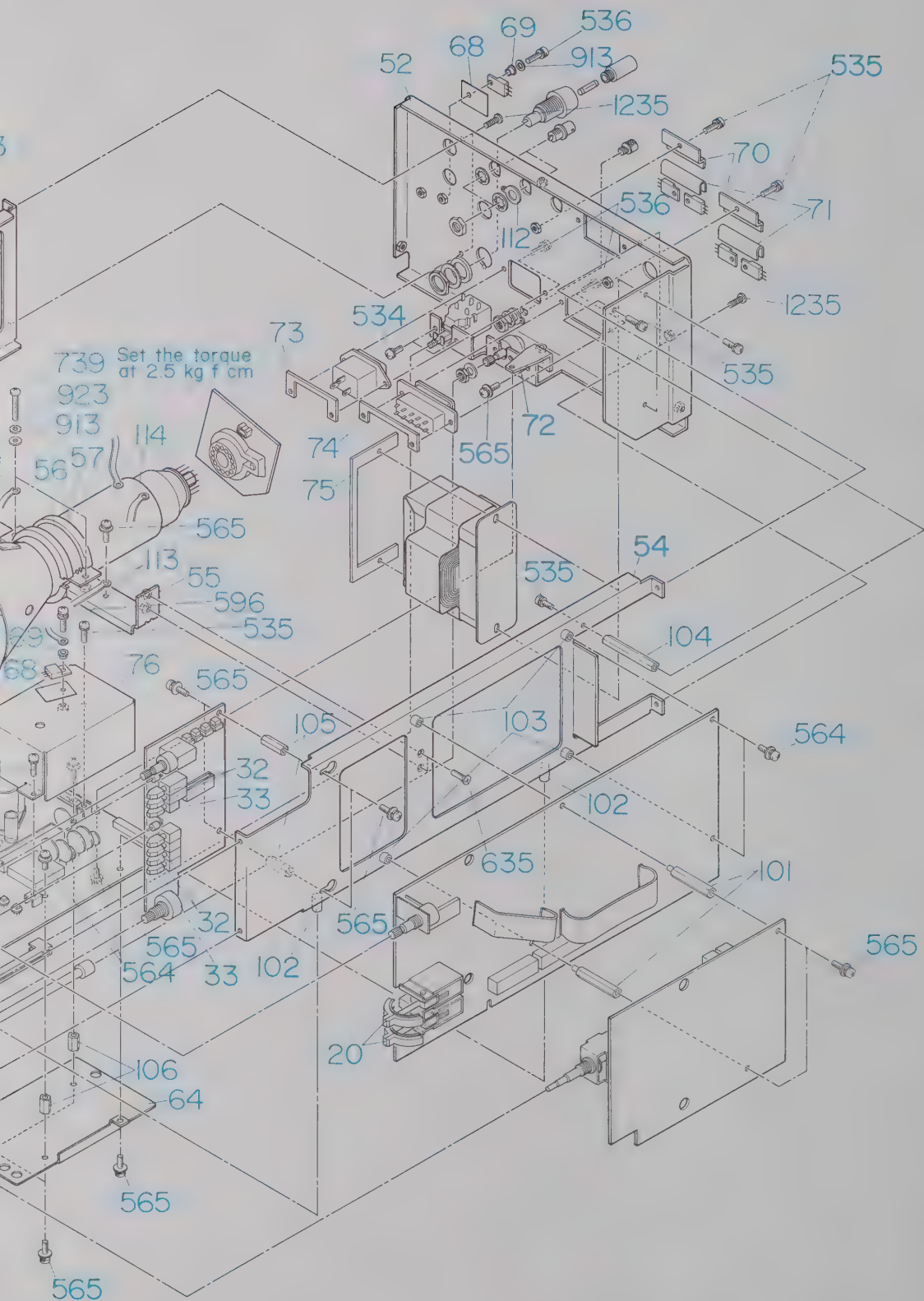
INDEX NO	NAME & DESCRIPTION	Q'ty	IWATSU PART NO
1	COVER, upper	1	KBA547011
2	COVER, lower	1	KBA547121
3	PANEL, front print	1	KPA161211
4	PANEL, rear	1	KCM073511
5	COVER, panel (option)	1	KCM073711
6	HANDLE, A	1	ACM001211
7	HANDLE, fixed	2	KBA059451
8	SEAT PLATE, screw	2	KBA059831
10	FILTER, frame	1	KCM060411
11	FILTER BOARD B	1	KPL014811
12	BEZEL	1	KCM060411
13	STOPPER, filter		KPL013411
14	STAND	1	KMM209711
15	FOOT, E	4	KCM057421
16	FOOT, rubber	4	AGM001311
17	STOPPER for FOOT, 6.2 ϕ	4	ACM001311
20	KNOB, LS	2	KCM073811
21	KNOB, A301760 DGC	2	KCM073131
22	KNOB, N111230 SRP	2	KCM060911
23	KNOB, K141360SG	5	KCM061411
24	KNOB, S181580 DGA	1	KCM074011
25	KNOB, N111230 SWP	1	KCM066211
26	KNOB, S181580 DGC	1	KCM074011
27	KNOB, K101160 SW	1	KCM061111
28	KNOB, K141360 SGP	4	KCM061511
29	KNOB, A471560 DGC	1	KCM072911
30	KNOB, A301540 DGC	1	KCM073021
31	KNOB, N101220 SR	1	KCM060811
32	PS knob D1	12	KCM062011
33	PS knob D2	5	KCM062111
34	PS knob C1	1	KCM061911
35	TIMING PANEL support B	1	KCM061811
36	TIMING PANEL	1	KPA158511
37	NAME PLATE, title	1	KRA117411
38	NAME PLATE, B serial number	1	ARA002711
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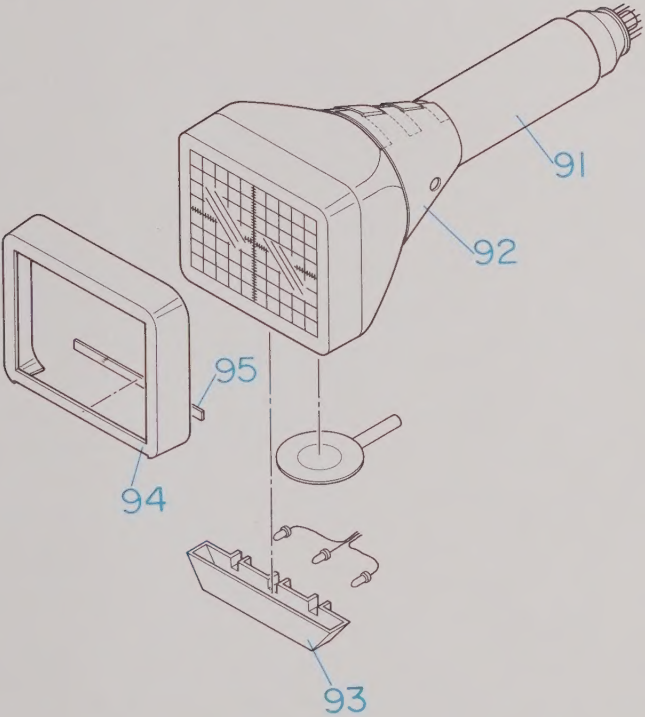


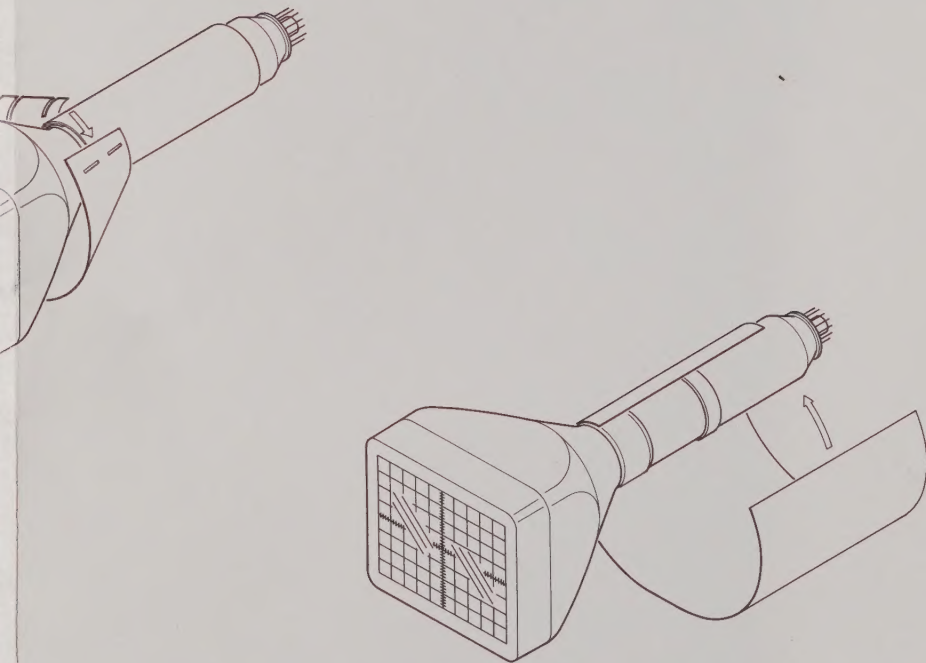
INDEX NO	NAME & DESCRIPTION	Q'ty	IWATSU PART NO
534	SM1 — 3 x 6		MSM130061
535	SM1 — 3 x 8		MSM130081
536	SM1 — 3 x 10		MSM130101
564	SM5 — 3 x 6		MSM530061
565	SM5 — 3 x 8		MSM530081
566	SM5 — 3 x 10		MSM530101
596	S4 — 3 x 10		MSM430101
635	KD (+) 3 x 8		MKD130081
735	KP (+) 3 x 8		MKP130081
739	KP (+) 3 x 16		MKP130161
913	PW 3 ϕ		MPN130001
923	SW 3 ϕ		MSW130001





INDEX NO	NAME & DESCRIPTION	Q'ty	IWATSU PART NO
91	CRT SHIELDED PLATE	1	KBA487821
92	CRT SHIELDED PLATE B	1	KBA547911
93	SCALE ILLUM LAMP PLATE	1	KCM056111
94	CUSHION, CRT	1	KGM009631
95	TAPE		





MP MASTER



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